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Editorial

# Back Pain: How to Avoid Surgery?

YiLi Zhou and Stephen Irwin

Treatment of low back pain remains a dilemma. In the USA more than 300 thousand back surgeries are performed each year. For about 10% to 39% patients, pain may continue or even get worse after back surgeries[1]. This condition is called failed back surgery syndrome. In the USA, about 80,000 new cases of failed back surgery syndrome are accumulated each year[2]. Pathological changes such as recurrent disc herniation, arachnoiditis, scar tissue formation, poor surgical indication, misdiagnosis, and surgical technique failure can all contribute to the failure of surgery. Pain after back surgery is difficult to treat. Many patients have to live with pain for the rest of their lives with severe disability.

Over the last several decades, our understanding of the causes of low back pain has been challenged. With a sensitivity up to 95%[3], MRI has been used a gold standard for the diagnosis of spine disease such as lumbar disc herniation. With the "MRI evidence" of a disc herniation and nerve root compression, patients are more easily convinced surgery is their best and only option. However, the reliability of MRI as the evidence for surgical decision has been questioned. An early study found that in a group of asymptomatic volunteers at age of 60 years or older, about 57% had abnormal MRI findings including disc herniation and spinal stenosis[4]. Follow up studies have yielded similar results. Now it is widely accepted that degenerative disc disease, such as disc herniation is a common finding in asymptomatic adults. Even though at the age of 60 years or older, 57% or more may have abnormal MRI findings in the lumbar spine, however, only less than 20% of this group of people have chronic low back pain. A recent study also suggested a lack of correlation between imaging findings of spine degenerative change and back pain[5]. Simply, degenerative change in the lumbar spine, such as a herniated disc, is not necessary painful.

The results of these studies have changed our belief in the relationship between lumbar disc herniation and back pain. It is believed that back and leg pain in the presence of acute disc herniation is not merely the result of a pinched nerve root, rather it is more related to the inflammation of the nerve roots and nerve endings around the herniated disc or it may be the combined results of chemical inflammation and mechanical compression[6]. A herniated disc is not a sole indication for back surgery and up to 70% to 95% of patients may be pain free after 12 months without major intervention[7]. The primary goal of treatment of lumbar radicular pain should be the suppression of inflammation, relieving the pain and restoring function rather than removal of the herniated disc. Before one chooses an open back surgery the following options should be considered:

Diagnosis: Low back pain can be related to a herniated disc, nerve root irritation, annular tear, facet joint arthritis, muscle spasm, injuries to the ligament, sacroiliac joint arthritis and referred pain from visceral organs. An MRI finding of a herniated disc, no matter how large, is not enough to justify surgery. A thorough history and physical examination is tantamount to judge whether the herniated disc is the real source for the ongoing pain.

Medications: Non-steroid anti-inflammatory medications should be offered as the first line medication to patients with mild back pain. Early administration of oral steroid medication in patients with acute sciatica may lead to slightly more rapid improvement in pain, mental well-being, and disability scores[8]. Anti-depressants, especially tricyclic antidepressants, are often used to treat patients with chronic back pain.

Physical therapy, massage therapy and chiropractic management have been widely used for treatment of back pain and lumbar radicular pain, even though the value of these treatment modalities have yet to be proven.

Spine injections: Multiple double blind, clinical controlled studies have confirmed the clinical efficacy of lumbar epidural steroid injection (LESI) in relieving the acute radicular pain due to herniated nucleus pulposus, speeding the rate of recovery and return to function[9]. The pain relieving effect of LESI may last up to three months. Inflammatory mediators, such as phospholipase A2, have been implicated in lumbar radiculopathy and disc herniation and have been the focus of recent research. Lumbar epidural steroid injections can decrease pain by suppressing the function of inflammatory mediators. As long as the patient is pain free and is without any neurological deficits, a herniated disc should not be a clinical concern. Even though LESI alone may not decrease the necessity of back surgery, it will be intriguing to investigate whether a combination of LESI and other treatment such as physical

therapy and life style modification will decrease the need for surgery.

Minimally invasive surgery: Minimally invasive surgery offers another alternative in the treatment of back pain. These treatments include chymopapaine, percutaneous nucleotome, automated percutaneous lumbar discectomy, laser discectomy, neucleoplasty and disc deKompressor. The advantage of the minimally invasive techniques is that it leaves no or minimal scar after the surgery. Among the minimal invasive techniques, laser discectomy has a reported success rate of 80% to 90%[10]. Neucleoplasty and disc deKompressor have been recently introduced with early non-controlled studies showing success rates up to 78%[11]. These procedures are still not widely accepted and more studies are needed to confirm their clinical efficacy.

Life style modification: Low back pain can often be the result of improper lifestyle choices. Smoking can increase the risk of low back pain[12]. Obesity can worsen back pain and contribute to disk degeneration[13]. Heavy lifting, sport related injuries and motor vehicle accidents can cause back pain. Education to patients with low back pain is critical to help them recover from back pain and prevent future back pain. Smoking cessation and weight control should be strongly recommended to back pain patients. Proper exercise techniques should be taught. Patients, especially those with spinal stenosis often have difficulty walking due to neurological claudication. Treadmills and long distance walking exercise may exacerbate back pain. Some studies suggested therapeutic aquatic exercise is potentially beneficial to patients suffering from chronic low back pain[14].

Conclusion: Lumbar spine surgery can potentially provide quick pain relief and functional recovery. There are many downsides to surgery however that would include post laminectomy surgery syndrome and a lack of proven long term benefit. Because of these risks one should be very careful in determining surgical candidacy. A preliminary study[15] has provided the evidence that the rate of back surgery can potentially be decreased through appropriate education and application of evidence-based medicine for patients, general practitioners and spine surgeons. Conservative treatment with the combination of medications, physical therapy, spinal injections and life style modification should be tried before surgery is considered.

**COMPETING INTERESTS**
None Declared

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Review Article

# Bacterial Infections and the Pathogenesis of Autoimmune Conditions

Gajanan Sherbet

**Abstract**
Bacterial infections are associated with many autoimmune diseases involving chronic inflammation and demyelination. The possible mechanisms of bacterial involvement as aetiological agents or in the exacerbation of these diseases have been investigated intensively. This review focuses the role of bacterial infections in the pathogenesis of autoimmune, inflammatory and demyelinating diseases. Possible modes of pathogenic action of bacteria are discussed, viz. the role of cytokines, Toll-like receptor signalling, the interaction of heat shock proteins with the immune system, and the role of nitric oxide. An auto-regulatory loop might exist in the interaction of bacteria with the host and in pathogenic signal processing. These studies reveal potential therapeutic targets.

**Abbreviations:** AQP4 Aquaporin-4; AS ankylosing spondylitis; CSF cerebrospinal fluid; EAE autoimmune encephalomyelitis; GB Guillain-Barre syndrome; HLA human leukocyte antigens; HSP heat shock protein; IL interleukin; LPS lipopolysaccharides; MAM Mycoplasma arthritidis antigen; MHC [proteins encoded by] major histocompatibility gene complex; MS multiple sclerosis; NK natural killer cells; NMO neuromyelitis optica; NO nitric oxide; NOS nitirc oxide synthase; PCR polymerase chain reaction; RA rheumatoid arthritis; SLE systemic lupus erythematosus; TLR Toll-like receptors; TNF tumour necrosis factor

## Introduction

Bacterial and viral infections are commonplace in a variety of autoimmune and chronic illnesses such as the chronic fatigue syndrome (myalgic encephalomyelitis), fibromyalgia syndrome, Gulf War illnesses and rheumatoid conditions[1-3]. Much attention is focused at present on the role of bacteria and the possible mechanisms of their involvement in the pathogenesis of several diseases. The route of infection and penetration and the immune responses of the host can not only make any bacterial infection pathogenic but probably can also determine the aggressiveness of the disease and the chance for full recovery. Therefore the two basic elements addressed here are the association between bacterial infection and autoimmune disease and the involvement of the immune system in the disease process.

## Bacterial infections in rheumatoid conditions

A wide variety of bacterial infections have been associated with rheumatoid conditions. Rheumatic diseases might have a manifold aetiology with varying genetic susceptibility, but bacteria-related autoimmunity might be an important factor[4].

Mycoplasma infection, e.g. by M. pneumoniae, M. salivarum, and M. fermentans, has been strongly associated with RA (rheumatoid arthritis)[5-8]. There is often systemic infection of more than one species[8]. Mycoplasma antigens induce both cell-mediated and humoral immune responses. Enhanced levels of antibodies against MAM (Mycoplasma arthritidis antigen) have been found in sera from RA patients in comparison with antibodies against Staphylococcal enterotoxins A and B. Also antibody titers were higher in RA serum than in systemic lupus erythematosus, ankylosing spondylitis, psoriatic arthritis, Reiter's syndrome, or healthy controls.

The mycoplasma antigen MAM can activate T cells. MAM contains two domains, one of which can inhibit lymphocyte proliferation; the second domain, which contains concanavalin A motif-β, is required for T cell activation[9]. It can also up regulate natural killer cell activity[10]. Furthermore, synovial tissues of RA patients contain T-cells, which bear the same T-cell receptors as used by MAM. The mitogen seems to be capable of initiating and exacerbating arthritic changes[11, 12]. MAM is a zinc-dependent antigen that binds to MHC class II molecules. Zinc induces MHC protein dimerisation required for MAM binding, MHC-induced cell-cell adhesion, and efficient T cell activation[13, 14]. As discussed in later sections, MAM can alter cytokine expression profiles and activate and modulate nitric oxide synthase (NOS) signalling pathways.

Bacterial DNA isolated from rheumatoid arthritis (RA) and juvenile arthritis has included Haemophilus influenzae, Bordatella and Yersinia as possible infecting organisms[15]. Lyme arthritis, which resembles rheumatoid synovial infiltration by Borrelia burgdorferi, has often been suggested to be an autoimmune condition. The B. burgdorferi surface protein A (OspA161-175) is recognised by T-cells and HLA (human leukocyte antigen)-DR molecules that bind this T-cell epitope and to these events is attributed the development of autoimmunity following B. burgdorferi infection. However, these decline with antibiotic therapy[16]. Therefore, in spite of the perceived association, Drouin et al.[17] diligently searched for

peptides with sequence homology with OspA (165-173) and have concluded from their study that molecular mimicry might not be significant to pathogenesis. The epitope OspA (163-175) is the predominant epitope associated with Lyme disease. Serum reactivity against OspA is also found in RA patients[18]. Our knowledge concerning the interaction of B. burgdorferi with host tissues and cells is rather scant. Ghosh et al.[19] have suggested cytokeratin 10 as a potential autoantigen. Gavanescu et al.[20] reported that mycoplasma infections can result in the production of autoantibodies against centrosomes. It is not known if this cellular organelle is involved with autoimmunity in RA.

B. burgdorferi seems to be able to induce inflammatory responses including secretion of cytokines and cellular responses of the T-helper cell-1 (Th-1) type[21]. Beermann et al.[22] generated lipoprotein vesicles (LV) from this bacterium and incorporated them into peripheral blood mononuclear cells. The resultant LV-T cells were predominantly the immune effector CD8+. Furthermore, these cells destroyed autologous T-cells carrying LV. These data do indeed support the existence of an autoimmune condition. Overall, a conservative conclusion would be that the molecular mimicry and autoimmunity thesis is yet to be fully tested.

Proteus mirabilis has been implicated in the pathogenesis of RA[23-26] and in osteoarthritis (OA)[27, 28]. Again, the HLA DRB1 alleles appear to be the major genetic susceptibility factors as postulated some years ago[29].

**Bacterial infection associated with other autoimmune conditions**

Bacterial infections have been identified in association with other autoimmune conditions besides RA. Members of the Enterobacteriaceae family are associated with autoimmune conditions such as Kawasaki syndrome and Graves' disease. Demyelinating diseases have been a focus of active investigation in the past few years. Kollef et al.[30] suggested that central and peripheral nerve demyelination might occur following M. pneumoniae infection. Since then patients with the autoimmune condition SLE (systemic lupus erythematosus) have been investigated for mycoplasma infections. Early studies revealed differences between SLE patients and control subjects in respect of genitourinary mycoplasma infections[31]. However, the deployment of more sensitive methods of detection has not supported these early claims. Runge et al.[32], for instance, found no difference in the incidence of Ureaplasma urealyticum in SLE patients, and they discount the notion that this mycoplasma species has any role to play in the pathogenesis of SLE. Nonetheless, there should be no serious doubts that mycoplasma infection can lead to demyelination.

The demyelinating neuropathy known as Guillain-Barre (GB) syndrome often has pathogenic association with bacterial infections. Campylobacter jejuni, Haemophilus influenzae and M pneumoniae have been implicated as possible causative agents of GB. C. jejuni is the major infecting organism here together with M. pneumoniae infection in some cases[33, 34]. GB is associated with the presence of antibodies against galactocerebroside, which is a major component of myelin[35, 36]. Some bacterial LPS (lipopolysaccharides) apparently bear molecular similarity to the human gangliosides GM1, GM1b, GD1a, and GalNAc-GD1a of the motor axolemma and are said to be the target epitopes for antibodies occurring in the GB subtype acute motor axonal neuropathy. The antiganglioside antibodies cause axonal neuropathy[37]. The host immune response to LPS moieties of the HB93-13 strains of C. jejuni cross-reacts with human nerve gangliosides and induce GBS[38]. .

Multiple sclerosis (MS) is a chronic inflammatory and demyelinating disease of the central nervous system. The pathogenesis of MS is possibly a consequence of autoimmune condition or infection by viral or bacterial agents. Both infections lead to the development of demyelinating plaques. Bacterial infections can evoke immune responses and induce demyelination. Infections of the brain parenchyma are sequestered from the immune system. Matyszak[39] has postulated a loss of the integrity of the blood-brain barrier at the foci of infection by a delayed-type hypersensitivity response leading to demyelination. Nitric oxide (NO), which enhances the permeability of the blood brain barrier, is found in greater quantities in the CSF (cerebrospinal fluid) of MS patients than of control subjects[4]. Also NO metabolite levels reportedly correlate with disease activity[41]. Other explanations have also been advanced. Gay[42] has drawn attention to the putative link of bacterial nasopharyngeal infections with optic neuritis, optochiasmatic arachnoiditis and MS. The possibility is aired that the blood barrier may be by-passed. Gay[42] points out the physical connection between CSF and the lymphatic drainage channels of the nasopharyngeal mucosa. So in the event, the CNS could be exposed to bacterial toxins and generate an immunological response. Many autoimmune diseases involve HLAs. The latter play a key role in antigen presentation to CD4+ Th cells. Specific regions of HLA e.g. HLA-C have robust association with MS and Graves' disease[43].

More recently serology and PCR (polymerase chain reaction) have provided ample evidence of Chlamydia pneumoniae, Borrelia burgdorferi, Mycoplasma species, human herpesvirus-1 and -6, among others in MS, amyotrophic lateral sclerosis Alzheimer's and Parkinson's disease[3]. Parratt et al.[44] looked at Chlamydia pneumoniae-specific immune complexes and have reported that C. pneumoniae infection is more frequent in MS patients and detected early in the course of the disease, presumably indicating an aetiological link. A tentative relationship between MS and streptococcal infection has been suggested[45]. But Budak et al.[46] have found no evidence of C. pneumoniae DNA in CSF samples. Similarly no Mycoplasma-specific nucleic acid sequences were detected[47] (Casserly et al. 2007). Lindsey and Patel[48] found no trace of bacterial 16S

DNA in the CSF of MS patients with progressive diseases or patients in remission. They tested for Campylobacter, Mycoplasma, Chlamydia, Bartonella, Mycobacteria and Streptococcus.

The aetiology and pathogenesis of MS and neuromyelitis optica (NMO) have been studied intensively from another angle in recent years. MS and NMO are related conditions; NMO could be a variant of greater severity than MS. Specific autoantibody responses have been identified in NMO patients. These are AQP4 (Aquaporin-4) antibodies generated against the water channel protein AQP4[49, 50] and they selectively target astrocytic end feet at the glia limitans (the external glial limiting membrane).

AQP4 antibodies are regarded as autoantibodies and so associated with the pathogenesis of NMO. The occurrence of lesions in the brain and spinal cord of NMO patients are consistent with the degree of AQP-4 expression[51]. The damage of astrocytes encountered in NMO is attributed to these antibodies. Serum IgG from patients with NMO binds to the extracellular domain of aquaporin-4; it is predominantly IgG1. Antibody binding to membranes expressing aquaporin-4 probably initiates demyelination[52]. HSP (heat shock protein) 70 has also been implicated in the autoimmune response leading to demyelination[53].

## Possible modes of pathogenic action of bacteria

### Molecular mimicry in pathogenesis

Most autoimmune diseases are associated with HLA types. RA and AS (ankylosing spondylitis) are classical examples of the association of HLA with rheumatoid conditions. More than 90% of RA patients possess HLA-DR1 or other sub-type and >96% of AS patients reportedly possess HLA-B27[54]. HLA-B27 antigen is also involved in reactive arthritis[55]. Spondyloarthropathies (SAP) are a group of HLA-B27-linked diseases, characterised by inflammatory pain in the spine and asymmetrical arthritis in the lower limbs. HLA-B27 transgenic mice spontaneously develop arthritis and they are susceptible to collagen-induced arthritis[56]. The involvement of HLA antigens in the pathogenesis of autoimmune diseases has been suggested to be due to the molecular similarities between certain bacterial antigens and HLA antigens. But there are no cross-reactive antibodies against bacteria and HLA-B27 in significant titres[57].

The autoimmune conditions of Graves' disease and Kawasaki syndrome are a result of the hyperactivation of the immune system. Bacterial infections have been implicated in both disease states. Yersinia enterocolitica, a member of the Enterobacteriaceae family, produces lipoproteins that are well known for their mimicry of the extracellular domain of the human thyrotropin receptor protein[58, 59]. This lipoprotein is mitogenic to B-cells[60] and induces the production of autoantibodies against the thyrotropin receptor. This could be the cause of hyperthyroidism associated with Graves' disease.

Chlamydial infection occurs commonly in chronic and acute diseases of the upper and lower respiratory tract and. also with atherosclerosis and asthma. Rheumatic autoimmune conditions also often show antibodies against the ribosomal protein L7. The L7 protein has been reported to contain epitopes bearing homology with a specific aminoacid sequence of the C. trachomatis RNA polymerase[61]. This has led to the suggestion that certain rheumatoid conditions could be due to the molecular similarity between L7 and the homologous sequence of the polymerase and generation of autoantibodies.

The autoimmune condition of SLE causes glomerulonephritis, arthritic changes and neurological alterations. SLE is another example of pathogenesis attributable to molecular mimicry between antigens of infecting agents and autologous proteins. As stated earlier, Campylobacter jejuni is the major infecting agent in patients with this disease. Hughes et al.[62] demonstrated the presence of antibodies against the ganglioside GM1 in SLE patients. Campylobacter infection has been linked with the perceived molecular mimicry of bacterial LPS with the human gangliosides of the motor axolemma and these are the target epitopes for antibodies that are believed cause axonal neuropathy[37].

### The role of cytokines in the pathogenesis of autoimmune conditions

Another line of evidence that links bacterial infections with RA and other inflammatory autoimmune conditions is the demonstration that bacterial antigens, such as MAM, induce the synthesis of pro-inflammatory cytokines, interleukin (IL)-1, IL-6, and IL-8[63, 64]. Furthermore, the modulation of the synthesis of cytokines by MAM corresponds with the induction of arthritic changes in mice[65]. The induction of IL-13 expression appears to be up regulated in human fibroblast cell lines when the cell cultures are contaminated by mycoplasmas[66]. IL-6 and IL-8 are induced in human gingival fibroblasts by a host of mycoplasma species, e.g. M. hominis, M. arthritidis, M. arginini, M. fermentans, M. penetrans, M. pirum and M. pneumoniae[64]. Glycolipid antigens of M. fermentans have been identified as important mediators of pathogenicity. The induction of TNF (tumour necrosis factor) together with cytokines and prostaglandins was reported some years ago[67, 68]. TNF is produced in response to M. fermentans antigens[69]. TNF-β induced by M. fermentans appears to enhance cytokines that can modulate the immune system. Exposure of human lung fibroblasts to M. fermentans induces IL-6, IL-10 and IL-12, IL-1β, IL-8 (now designated as CXCL8), the monocyte chemoattractant protein-1 (MCP-1) also known as CCL2 (CC chemokine ligand 2), and the chemokine (C-X-C motif) ligand 1 (CXCL1) production[69, 70]. Kawahito et al.[71] used monoclonal antibody against the M. fermentans glycolipid antigen GGPL-III and detected it in synovial tissues from RA patients. The

antigen was not detectable in OA or normal synovial tissues. Furthermore, GGPL-III induced TNF-α and IL-6 production by peripheral blood mononuclear cells, and also induced proliferation of synovial fibroblasts. However, anti-phospholipid antibodies are generated in response to a number of bacterial infections[72]. So their presence alone might not be clearly linked with pathogenesis.

Toll-like receptor signalling in immune responses to infection

The generation of immune responses to lipopolysaccharides (LPS) is mediated by a class of receptors called Toll-like receptors (TLRs). These are transmembrane receptors that activate immune cell responses. TLR can recognise molecular patterns associated with pathogenic infectious agents; among them of note are LPS, viral RNA, and unmethylated CpG-oligonucleotides.

The TLR signalling mechanism has been the focus of much attention. Exposure of cells to LPS or other toxins induces the expression of different forms of TLR and different pro-inflammatory interleukins and interferons[73]. Inflammatory responses to M. arthritidis lipoproteins require TLRs[74]. MAM of M. arthritidis has been shown to interact with TLRs[75]. MAM generates a differential immune reactivity mediated by different TLR types. The co-stimulatory molecules associated with the immune stimulation determine the outcome in terms of IL isoform produced and this depends upon which co-stimulatory factor interacts with MAM. Thus inhibition of co-stimulatory factor B7-1 leads to a shift from IL-2 to IL-1[76]. TLR signalling also involves caspases required for processing the precursors of IL-1β and IL-18. The TLRs use the adapter protein MyD88 and the so-called adapter-like MyD88 to activate signaling pathways, but only the latter interacts with caspase[77]. So here we have another potential means of regulating the expression pattern of pro-inflammatory cytokines. In other words, IL production pattern is determined by the co-operation TLRs. TLRs can synergistically or competitively modulate IL expression in immune response to infectious agents[78]. Equally, one can attribute specific TLRs of T-cells with the ability to directly stimulate Th1 and Th2 effector function and modulate the synthesis of cytokines and interferons, and influence cell proliferation and survival[79]. TLR function is closely related to Fcγ receptor (FcγR) expression. The cells of the immune system express receptors for the Fc region of Ig isotypes. FcγR for IgG links IgG mediated responses of the immune system[80]. TLR4 up regulates the expression of FcγR. IL10 is said to be involved in and mediate this up regulation[81]. Probably, as Loof et al.[82] have implied, TLRs might be functioning as a cohort of signalling channels interacting with one another rather than acting individually to generate an immune outcome. TLR signalling might be autoregulated; a concept that is worthy of investigation.

LPS seems to induce the production of interleukins via a TLR-mediated pathway. Exposure of the macrophage RAW264.7 cell line to LPS leads to Janus kinase (JAK)2 tyrosine phosphorylation with TLR4 mediation, then down stream to the phosphorylation of JNK {c-jun N terminal kinase) resulting in IL production[83].

Finally, TLR signalling is involved in the activation of innate immunity in defence from infections not only bacterial, but also viral and parasitic. NK cells, macrophages, dendritic cells are all capable of enlisting TLRs signalling in their function. The recognition of bacterial infection by NK cells seems to be mediated by TLR[84, 85]. Other infections e. g. by the parasitic protozoan Leishmania major, result in the induction of IL-12 in bone marrow-derived dendritic cells, IFN-γ expression and activation of NK cells. These events are mediated by TLR9[86].

The interaction of heat shock proteins with the immune system

Heat shock proteins (HSP) are a highly conserved family of stress-related proteins with diverse function such as protein folding and chaperoning, and novel and differential modes of function have now been ascribed to their functional repertoire. HSPs might chaperone antigenic peptides.

Antibodies against a number of HSPs have been detected in autoimmune diseases. Marked increases in antibodies against HSP70 and HSP90 occur in patients with RA[87], Klebsiella pneumoniae HSP60 in ankylosing spondylitis patients[88], HSP27 and HSP90 antibodies in patients with arthritis accompanying cystic fibrosis[89] and so on. T lymphocytes react to heat shock proteins and this probably plays an important regulatory role in the progression of autoimmune diseases. HLA-DR-T cell epitopes have been identified in HSP60 and HSP70[90-92]. In experimental systems HSP60 induces the production of IL-8 and TNF (tumor necrosis factor)-α and this is enhanced by HSP auto-antibodies. Sera from RA patients with higher anti-HSP60 auto-antibody titers also markedly increased the IL-8 production induced by HSP60 in a human monocytic cell line[93]. As yet, it is unclear what role HSP auto-antibodies might play in pathogenesis.

HSP are known to be able to influence both innate and adaptive immune response and induce the expression of interleukins under a variety of experimental conditions. Some HSPs induce and other can inhibit the production of interleukins. Bacterial HSPs bear sequence homology to human HSPs, and immunisation with bacterial HSPs has often inhibited disease progression[94]. Several HSP receptors have been identified to-date on antigen presenting cells. Among them are the Toll-like receptors TLR2 and TLR4. HSPs are recognised by appropriate receptors to initiate their participation in the signalling cascade[95, 96]. Singh et al.[97] showed that heat shock activated transcription factor HSF-1 (heat shock factor-1) binds to heat shock responsive elements in the promoter of genes coding for certain interleukins.

The TLR signalling pathway has been robustly implicated in HSP function. HSPs recognise and bind to pathogen-associated molecules and activate TLR mediated signalling. It appears possible that different HSPs might differentially activate TLRs thus determining the functional pathway. Thus HSP60 is said to bind to TLR1 but not to TLR2[98]; this could have differing consequences in terms of induction of cytokines. HSP70 bound to the cell membrane is said to specifically activate NK cells, whilst intracellular HSP70 exerts immunomodulatory effects by binding specifically to TLR2 and TLR4. In vitro studies have suggested that HSP70 is actively released in response to heat shock and induces the production of IL-10 in fibroblast-like synoviocytes by TLR4 signalling[99]. HSP72 induces IL-8 expression by activating TLR4 and NF-kappa B[100].

The role of nitric oxide in the pathogenesis of autoimmune, inflammatory and demyelinating diseases

Nitric oxide (NO) is synthesised by NO synthase (NOS) which occurs as neuronal, endothelial and inducible isoforms. NO subserves many functions. Most prominently, it is a vasoactive agent regarded as contributing significantly to the pathogenesis of inflammatory immune and neurodegenerative diseases. RA, SLE, MS, and experimental autoimmune encephalomyelitis (EAE), an experimental model of MS, all show associated synthesis of NO, superoxide and their toxic products. Upon infection bacterial components bind to macrophages using TLRs and this leads to the production of TNF-α, which in turn induces to the synthesis of NO. NO is also expressed by cells when exposed to IFN-γ. NOS is required for bacterial clearance during infection[101]. The general and overall effects would be bactericidal in nature.

Arthritic changes occurring in an animal model called adjuvant-induced arthritis, which exhibits features similar to those of RA, accompany the induction of NOS. Furthermore, NOS inhibitors suppress the arthritic changes[102]. Mouse peritoneal macrophages and a macrophage cell line have been reported to synthesise NO in response to MAM. This is enhanced by LPS possibly via TLR2 but not TLR4 signalling[103, 104]. M. hominis lipophilic component also interacts with TLR2 not TLR4[105]. M. synoviae lipoprotein lipid moiety induces NO secretion by chicken macrophages[106].

Nitric oxide (NO) enhances the permeability of the blood brain barrier. The invasion of the CNS by inflammatory cells and the development of EAE are prevented if the toxic product peroxynitrite of NO and superoxide are scavenged[107]. Both constitutive isoforms of NOS, neuronal and endothelial, and inducible NOS are active in the demyelination process[108]. NOS has also been implicated in the pathogenesis of Parkinson's disease[109].

Demyelination can be induced by mycoplasmas. NO, inflammatory cytokines, and prostaglandins are induced when glial cells are exposed to M. fermentans antigens[68]. Heat shock inhibits both NO and iNOS (inducible NOS)[110, 111]. Bacterial LPS-induced expression of NOS can be inhibited by exposure of cells to hyperthermia at 43°C. Transfection of HSP70 reduces iNOS expression[111, 112]. From the foregoing discussions one can visualize a complete regulatory picture of the involvement of HLAs, HSPs, cytokines and nitric oxide in the pathogenesis of inflammatory immune diseases.

Although NO is harmful to bacteria, it can induce apoptosis in some cell systems[113] and cause necrosis (see Naito et al.[114]). The toxicity of NO can result in immune suppression and in turn lead to enhanced infection[115]. Bacteria also seem to have evolved protective mechanisms against these deleterious effects. So host resistance to bacterial infections and the ability of bacteria to initiate inflammatory and demyelinating conditions leading to pathogenesis are finely tuned. The understanding of the control mechanisms has not only expanded our knowledge of the possible modes of bacterial involvement in pathogenesis, but it has also led to the identification of potential targets for therapy. The activation of signalling pathways mediated by TLRs has afforded an avenue of therapeutic approaches to autoimmune conditions. TLR signalling together with its cognate receptors and adapter molecules can conceivably be employed as specific targets for therapeutic intervention. The TLR agonists have been found to enhance immune responses, especially against tumours[116]. Some agonists have been approved for the treatment of certain human disease conditions[117, 118]. There is also much scope for the detection of bacterial infections via TLRs. As discussed earlier the TLR signalling pathway might be implicated in potential crosstalk with other interacting signalling systems. In other words, a composite regulatory operation of many pathways involving TLRs can be delineated in the pathogenesis of autoimmune diseases.

It would not be out of place to inquire here into the potential clinical benefits of studying the role of bacterial infections and the mode of their participation in the disease process. The prevention of disease progression is one of the benefits, in which not only the identification of the infecting agent but also the mode by which the infectious agents might trigger initiation and progression would make a valuable contribution. Specifically targeted intervention modalities using antibacterial therapy can evolve and develop from such basic research. Also these would find much application in the development of healthcare facilities such as antimicrobial 'stewardship' programmes and infection control programmes to monitor effects of treatment and treatment costs[119]. Unavoidably the cost effectiveness of treatment regimes comes into reckoning. This makes it imperative that factors which determine antibiotic-resistance of bacteria are identified and adequately addressed.

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**COMPETING INTERESTS**
None Declared

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Review Article

# '*Plus ca change*': Back to the future

**Malcolm P Weller**

*Where several different objects produce the same effect, it must be by means of some quality, which we discover to be common amongst them. For as like effects imply like causes, we must always ascribe the causation to the circumstance, wherein we discover the resemblance.*
David Hume, A Treatise of Human Nature

*The present findings suggest that even if everyone was treated in the best possible fashion, about 60% of the burden of mental disorders appears to be unavertable in the light of current knowledge…even with perfect coverage and treatment, half the burden of anxiety disorders would remain unavertable.*
Andrews G, Issakidis C, Sanderson K, Corry J, Lapsley H: Utilising survey data to inform public policy: comparison of the cost-effectiveness of treatment of ten mental disorders. Br J Psychiatry 2004; 184:526–533

Psychiatric conditions tend to cluster together so that if a person suffers from one neurotic psychiatric disorder that person is significantly more likely to simultaneously suffer from another, so called comorbidity, and sufferers from psychiatric disorders are more likely to suffer psychiatrically again in the future in comparison to a random population.

The situation in respect of post traumatic stress disorder (PTSD) might be expected to be somewhat different because, atypically, in this disorder we presume that we know the aetiology and it is a necessary diagnostic criterion that a person has been exposed to an unusually threatening event. Nevertheless, there is recent evidence that the likelihood of recurrence of PTSD is high, despite the low frequency of catastrophic precipitating events.

The various symptomatic manifestations, upon which specific psychiatric diagnoses are based, may be surface phenomena of a unifying underlying predisposition with common biological substrates. This would accord with the fact that antidepressants are effective not only in psychotic depression, melancholic type depression and non-melancholic depression but confer a wide spectrum of additional therapeutic benefits, including benefit in panic disorder, phobic disorders, obsessive compulsive disorder and PTSD.

Alternative or aggravating factors are that people who suffer from a neurotic disorder or disorders tend both to complain more and to attract adversities.

These issues will be discussed in relation to the psychological concepts of neuroticism and recent biological factors.

## Recurrence of disorders

Depression

Once initiated depression tends to recur (DSM - IV), in his review, Judd[1] found that about 80% of persons experiencing a major depressive episode will have at least 1 more such episode during their lifetime, with the rate of recurrence being even higher if minor episodes are included. The review by Judd[1] is close to the more recent estimate of Andrews[2] that over the 10 years following a depressive episode, 75% of patients experience a recurrence[2].

Depression resulting as a reaction to stress (in which environmental demands are perceived as exceeding resources) is particularly likely to pursue a chronic and relapsing course[3;4].

Anxiety Disorders

Anxiety is often an appropriate emotion which should lead to behaviour which reduces the anxiety rather than a disordered state of frozen inactivity or maladaptive actions which exacerbate the anxiety.

Anxiety disorders are known to be familial and heritable[5] and tend to be persistent. They can be associated with depression or be the prelude to depression[6].

The severity of symptoms may vary with time and be less problematic in calm, uneventful circumstances but panic disorder with or without agoraphobia often remains a chronic condition[7;8].

PTSD

The definition of PTSD stands in contrast to adjustment disorder. In DSM IV an adjustment disorder is characterised by a disproportionate reaction to the stressor and therefore probably indicative of prior psychiatric vulnerability. This interpretation is reinforced in ICD 10; "Individual predisposition or vulnerability plays a greater role in the risk of occurrence and the shaping of the manifestations of adjustment disorders than it does in the other conditions in F43 (Acute Stress Reaction)". However, the notion that certain experiences can trigger a disproportionate reaction in some people by virtue of some perhaps occult vulnerability exhibiting a much greater susceptibility, a disproportionate effect, was commented on in the second World War for conditions which we would now diagnose as PTSD (e.g.[9]). An early Israeli study of soldiers exposed to combat traumas[10] suggested that prior combat stress reactions was a marker for subsequent similar problems rather than part of a process of aggregation of stress.

The majority of people will experience one or more traumatic events in their lifetimes, with estimates ranging from 51% to 90%11;12. Despite the shared nature of the experience, after natural disasters such as earthquakes, volcanic eruptions, tsunamis and of combat, only a minority of the population exposed to similar stressful experiences suffer from PTSD. Those who succumb are likely to have experienced prior psychiatric problems[13;14;15].

Prior psychiatric problems, less education, high neuroticism, extroversion, and certain ethnic grouping are associated with the development of PTSD [16;14;15;17;18;19;20;21;22]. In the Blanchard et al[17] study, prior depression was associated with Post Traumatic Stress Disorder following a motor vehicle accident to a highly significant extent, (P<0.004).

## Risk factors

Pervasive factors which reconciles the various studies is the finding that temperamental characteristics, detected very soon after birth, proved to endure and to predict later behaviour and adjustment[23]. The personality dimension of adult neuroticism renders an individual vulnerable to neurotic disorders but there are elements of double counting. However, it is stable trait when corrected for age[24].

Those who are psychiatrically vulnerable are likely to succumb to the impact of significant life events, particularly if they have demonstrated that they have already done so in the past, which situation could be interpreted to indicate that they have less resilience to stress.

Provocation tests are used in medicine, such as the glucose tolerance test for unmasking diabetes and the dexamethasone suppression test for testing for possible pituitary autonomous or semiautonomous malfunction in Cushing's syndrome. In an analogous fashion, it could be assumed that a latent psychiatric vulnerability would be revealed by psychosocial stress.

The propensity to experience traumatic events has cultural, educational and personality roots. Among young American adults, those with less education, blacks, and those with high extroversion scores (with a propensity for sensation seeking) are more likely than others to be exposed to traumatic events and are thus at greater risk for PTSD[16].

Age, gender, race, and socioeconomic status are relevant parameters, with youth, female sex and low socioeconomic status being markers for an increased likelihood of developing PTSD[25;26;27;28]. The level of social support and individual self-esteem, have also been implicated in the onset and course of PTSD across cultures[29;30;31].

This literature is suggestive of prior psychiatric, social and socio-economic pressures being conducive to PTSD and would inferentially support prior PTSD as being a marker, amongst other psychiatric markers, of psychiatric vulnerability arising from a variety of factors.

A very recently published study from Naomi Breslau and her team, who have conducted a series of influential studies, brings additional and more direct evidence that prior PTSD is in fact a vulnerability marker, rather than the consequence of cumulative stress for the eruption of subsequent PTSD[32].

In this study, a sample of 1200 persons was randomly selected in 1989 from all 21-to 30-year-old members of a large health maintenance organization and were repeatedly assessed over a 10 year follow-up.

The conditional risk of PTSD during the follow-up periods was found to be significantly higher among trauma-exposed persons who had experienced previous PTSD, relative to those with no prior trauma (odds ratio, 3.01; 95% confidence interval, 1.52-5.97). The estimates were only marginally revised after adjustment for sex, race, education, and pre-existing major depression and anxiety disorders.

In contrast, the conditional risk of PTSD during follow-up among trauma-exposed persons who had experienced prior traumatic events but not PTSD was not significantly increased, relative to trauma-exposed persons with no prior trauma. The difference between the 2 estimates was significant (P = 0.005). The authors concluded that *"prior trauma increases the risk of PTSD after a subsequent trauma only among persons who developed PTSD in response to the prior trauma. The findings suggest that pre-existing susceptibility to a pathological response to stressors may account for the PTSD response to the prior trauma and the subsequent trauma."*

One can only speculate as to why the individual developed PTSD in the first place. It has been argued on the basis of the Israeli combat data[10] and natural disasters[16;13;14;15] that the first

episode of PTSD is likely to be a manifestation of psychiatric vulnerability rather than a manifestation of exposure to universally intolerable stress. These studies, particularly the most recent of Breslau and her team, have medico-legal implications which accord with the U.K. legal concepts of "nervous shock" and "eggshell personality" (Malcolm v Broadhurst [1970] 3 All ER 508).

In a similar fashion, Hammen et al[33] found that non depressed persons were relatively resistant to the onset of depression, even when exposed to high- impact stressful events, whereas those who were symptomatic continued to have both more depression and more high-impact events over time. This may be partially a recording bias, because depressed people may better remember adversities and problems but there may be a further reason. In our competitive society, there seems to be some magnet-like effect of depressed people inducing others to assert their dominance and, metaphorically, to kick them while they are down, probably because of inadvertent signals of loss of self esteem and being an incapacitated adversary[34].

The converse is also true, with well-being decreasing life events vulnerability[35].

Brown Harris and Eales[36] have illustrated the various implications of this interaction, particularly as to anxiety in the early and residual phases of depression.

Recent biological evidence has shown a strong interconnection between the personality trait of neuroticism and depression. Neuroticism is associated with characteristics of serotonin receptors[37;38] and the weight of evidence is that the short variant of the serotonin transporter gene is associated with depression[39;40;41], although there is a contradictory study[42].

## Comorbidity

Between 48.6% and 51% of patients with a DSM-IIIR/DSM-IV diagnosis of major depression had at least one concomitant ('comorbid') anxiety disorder and only 26% to 34.8% had no comorbid mental disorder[43;44].

Comorbid depression occurred in 44.5% of PTSD patients at 1 month and in 43.2% at 4 months in 211 trauma survivors and was associated with greater symptom severity and lower levels of functioning[13].

In an Australian study, 21% of people fulfilling DSM-IV criteria for any mental disorder met the criteria for three or more comorbid disorders[45]. In a recent large-scale epidemiological study of 9,282 English-speaking respondents 18 years and older the researchers found that almost a quarter (23%) had 3 or more diagnoses, a situation which correlates with severity[46]. Using data from community surveys, many researchers have noted that if the range of psychiatric symptoms properly dictates 2 or more diagnoses, this is associated with greater symptom severity[47;48;49;50;51], poorer outcome[47;50] and poorer treatment response[52], more functional impairment[47,48;53] and increased use of medical service[54;55;56;57] (see Wittchen[58] for theoretical discussion of comobidity).

Earlier, Kessler[59] and Angst[60] had noted that people who had more than one diagnosis at some time used services more often. Later work in a study of 10,641 adults showed a strong relationship between the number of disorders and disability and distress, with the combination of affective and anxiety disorders associated with four-fifths of the disability and service utilization[45].

## Ubiquity of stress

Certain stresses are inevitable, such as bereavement and one expects a period of readjustment. Despite the fact that stresses rain down upon us[61;11;12;62] it is still the majority of the population who are not given a formal psychiatric diagnosis. A genetically determined constitution or an adverse childhood could well determine resilience and susceptibility to their impact. Complicating a model of exclusive social inculcation, childhood adversity is generally the product of parental behaviour by persons of shared genetic constitution.

## Social Factors

The interaction between adversity and vulnerability, and the moderating effects of social integration and support are well known. Writing in the late 70's, a major research programme by Brown and Harris concluded: *"attention to a person's environment may turn out to be at least as effective as physical treatment."* Clinically significant anxiety is much commoner amongst single people[63]. The situation is interactive in both directions. Psychiatric symptoms are likely to cause adverse social consequences and to be aggravated by these consequences, and multiple symptoms are more likely to have even greater adverse social resonances[64;65;66;67;68;69;70;71].

## A unifying model

"The child is father of the man" and half of all lifetime psychiatric cases start by age 14, and three fourths by age 24 [46a], later-onset disorders occur in large part as temporally secondary comorbid conditions[46b] and the effect of aging on brain function may explain some of the late onset depressions[72;73;74;75;76].

Linkage between the various neurotic disorders (i.e., anxiety, depressive, phobic, and obsessional neurosis) and the centrality of the neurotic disposition pervading all used to be commonly assumed. The subdivision in the DSM classificatory systems beginning with the third edition created a more rigid subdivision, which has been criticised adversely (e.g.[77]).

The personality factor of neuroticism is a pervasive risk factor for a variety of psychiatric illnesses (e.g.[24;16;45]). The temperamental characteristics may be no more than a *forme*

*fruste* of illness which is highlighted by stress. People have varying coping capacities which are a product of their temperament and childhood experiences but the interaction, with adaptive and maladaptive responses, has even greater explanatory power. Parenting style and adequacy has been emphasised by the psychoanalytical movement and includes parental adjustment as interwoven with child rearing practices as well as with shared genetic propensities. On the other hand, enduring temperamental characteristics have been exhibited extremely early in life[23;78;79] and are likely to be biologically determined and to introduce interactional biases in the developmental trajectory.

There are 3 models of the impact on mental health of adult trauma:

1. Repeated traumas, sometimes beginning in childhood produce a cumulative destructive effect and increasing sensitisation to further traumas (e.g.[80]).

2. Repeated small traumas produce a "stress inoculation" increasing resilience, in a manner analogous to the term “battle hardened”.

3. Prior psychiatric problems, perhaps surprisingly including PTSD, are markers of psychiatric vulnerability and predictors of subsequent psychiatric problems, including a further episode or episodes of PTSD.

The models do not conflict with one another but the recent study of Breslau et al[32] provides empirical data emphasising the third possibility.

**Treatment**

Neurotic psychiatric disorders have a common underlying predisposing cause which can be modified by SSRIs and CBT.

Claims are made for the effectiveness of exploring and reconciling childhood experiences and relationships and short-term psychodynamic psychotherapy has also proved to be an effective treatment (e.g.[81]).

Depression is often mixed with anxiety or develops from anxiety. Anxiety disorders are by far the most common mental disorders but the proportion of serious cases is lower than for other classes of disorder. Mood disorders are the next most common with a higher proportion of serious cases[46].

Cognitive factors, especially the way people interpret or think about stressful events, are considered to play a pivotal role in the aetiology of anxiety[82] and negative thoughts are frequently found in individuals with anxiety[83].

Anxiety is associated with a tendency to overestimate the association between a feared cue and personal harm[84;85;86]. Prominent negative thoughts in anxiety are underpinned by a sense of uncontrollability, feelings of helplessness and a perception that the sufferer is unable to predict, control, or obtain desired results[82].

An amplifying factor in demands upon treatment is that high neuroticism contributes to patients' over-reporting of mood symptoms and help seeking, e.g.[87]. Appropriate treatment of neurotic disorders includes educating sufferers to identify and examine their negative thoughts, and to see if they can re-construe them in a more realistic and constructive way.

Such cognitive behavioural therapy both promotes recovery and also guards against recurrence. In accord with biological findings regarding variance of the serotonin receptor, these twin advantages can also be obtained from continuing pharmacological treatments (e.g.[88;67;89;90;91;92;93]). The effect is amplified if the two approaches are applied in combination[94;95;96;97].

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**COMPETING INTERESTS**
I have prepared expert witness evidence where I have been instructed by claimants and defendants both jointly and severally

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Review Article

# The Revolution in Inpatient Care: Hospitalist Program

**Mohammed Moizuddin, Quretul Quresh and Qasim Raza**

Society of Hospital Medicine (SHM) defines 'Hospitalists' as physicians whose primary professional focus is the general medical care of hospitalized patients. Their activities include patient care, teaching, research, and leadership related to hospital medicine.

The term "hospitalist"[1] was first introduced in 1996 by Robert M. Wachter and L Goldman to describe physicians who devote much of their professional time and focus to the care of hospitalized patients. In the most prevalent American model of hospitalist care, several doctors practice together as a group and work full-time caring for inpatients. Most of the (80%) of practicing hospitalists are board certified or eligible in internal medicine, and some (5%) have completed subspecialty fellowships. Although hospitalists first emerged in the care of adult inpatients, the field has grown rapidly in pediatrics, now accounting for nearly 10% of U.S. hospitalists[2]. Hospitalists typically provide 24/7 inpatient coverage and thus are more readily available to a patient than a doctor who spends much of the day outside the hospital in an office or clinic setting.

Over the past decade, the United States has undergone a remarkable evolution in the way it delivers inpatient medical care. In the mid-1990s, much of American health care was dominated by a managed care paradigm, which gave incentives to control health care inflation[3]. Hospitalist model was uniquely well versed in evidence based practice and systems improvement. Their focus on providing clinically appropriate care, improving efficiency, reduce length of inpatient stay and helping to make the hospital system work better, without compromising patient satisfaction & outcome was big boon for its growth. Hospitalist field has now become the fastest growing specialty in the history of American medicine, approximately today close to 15,000 hospitalists practice in America, and the field is likely to grow to about 30,000 making it a larger specialty than cardiology[4].

## Hospitalist Program, St Joseph's Hospital/Marshfield Clinic

In keeping pace with nation wide trend, St. Joseph's Hospital (SJH) Marshfield Clinic, Marshfield was developed in 2000 by the General Internal Medicine Department at the request of clinic leadership. Hospitalst Program was formally launched in October 2001. SJH was pioneer and leader during the time in the Midwest. Dr Qasim Raza & Dr Mark Schwartz were instrumental in establishing a full fledged hospitalist program that has grown tremendously over the years. Dr Bill Yanke, then Chairman of Internal Medicine made into a full subdivision in October 2005 under the leadership of Dr Qasim Raza as Medical Director and Dr Mark Schwartz as Associate Program Director. Today there are 24 full-time hospitalists providing 24/7 hours inpatient medical services, including consultative services to all sub-specialists at Marshfield Center. Their job also includes surgical co-management of all orthopedic patients admitted to St. Joseph's hospital.

Hospitalists typically work in 'shift' system, and on any given day we have about 7 day time non-teaching, 2-3 academic teaching, 1 back-up, 2 evening and 1 night time hospitalist covering all medical inpatient services. St. Joseph's Hospital/Marshfield has always been able to recruit the top graduating residents from Internal Medicine Residency/Med-Peds Programs across United States as we believe this is the first step towards success of our program. Many of our hospitalists are actively involved in academic research & teaching and hold Clinical Assistant Professor rank with School of Medicine & Public Health, University of Wisconsin, Madison.

Andy Weir, Director Quality & Strategic Analysis, St. Joseph's hospital (SJH), Ministry Health places our program among the top 15 in the State of Wisconsin. SJH continues to have a lower Length of Stay (LOS) for the top 25 DRG (Diagnosis Related Group) that usually makes typical hospitalist patients. In FY 2007 we still held a 0.16 LOS advantage compared to other 14 hospitals that round up the top 15 hospitals of Wisconsin. This literally means thousands of dollars saved for the patients in today's world of skyrocketing health care costs. This was achieved without significant compromise on quality of care or patient satisfaction. We have far few readmits when compared to our peers in other hospitals of the state. This was only achieved with hard work and dedication of our hospitalist team under the able leadership of Dr Roderick Koehler, Chairman of Internal Medicine Department and full support of Marshfield Clinic Board of Directors.

Marshfield Clinic physicians work in four other hospitalist programs besides St Joseph's Hospital/Marshfield Center.

Marshfield Clinic Euclaire, Minocqua & Wausau Centers have 4 full time hospitalists each. Marshfield Clinic Lake View Medical Center; Rice Lake has one full time hospitalist. This makes Marshfield Clinic almost the largest employer of Hospitalists (total of 37 today) in Wisconsin.

## The Future – Hospitalists are here to stay

Proponents say Hospitalists fill a growing gap in continuity of patient care. Typically Physicians spend more time today in treating patients in their offices than at hospitals. Hospitals are traditionally getting sicker patients than ever before, and no primary are physicians are willing to take care of unassigned patients (patients with no primary care provider privileged to work in their hospital). Hospitalists are easily available 24 hours daily to take are of these acutely ill patients. Primary care physicians and sub-specialists are happy in that they can spend more time in their practices. There is no competition as Hospitalists have no out-patient practice and their patients return back for follow-up appointments. It's a win-win situation for patients and physicians. Medicare and more insurance companies have now tagged reimbursement with quality of care provided to patients. Research has proven that in-house physicians are good for hospital's goal to achieve these targets[5].

**Table 1 Potential roles for hospitalists. ( Swiss Med Wkly 2006; 136:591-596 )**

**Clinical**
Inpatient Wards
Intensive Care Unit
Medicine Consultation Services
Palliative Care Services
Post-discharge Clinic Services
Pre-operative Clinic Services
Non-teaching services (in Teaching Hospitals)
Skilled Nursing Facilities

**Educational**
Residency Program Directorship
Student Clerkship Directorship
Curriculum Development and Leadership

**Operational**
Emergency Department Triage Officers
Bed Flow Coordination
Discharge Planning Coordination
Transfer Center Coordination

**Quality & Safety**
Patient Safety Officer
Director of Quality (Compliance)
Quality Improvement Officer

**Other**
Clinical Information Technology Implementation
Hospital Leadership Positions

Dr Robert Watcher in his landmark article in JAMA concluded that implementation of Hospitalist programs was associated significant reductions in resource use, usually measured as hospital costs (average decrease , 13.4%) or average LOS (average, 16.6%). All research till date has empirically proven that hospitalists improve in-patient efficiency without harmful effects on quality or patient satisfaction[6].

Hospitalists come from diverse training backgrounds and hence SHM has started implementing a process to start early training programs for hospitalists, including residency track and fellowship programs. Current educational deficits include training in communication skills, end-of-life care, quality improvement and patient safety, medical economics, follow-up of acute post-op surgical patients. Hospitalists are slowly expanding into other roles beyond the traditional role of medical consultant [Table 1].

## Hospital Medicine – New Specialty

Specialists in medicine are traditionally defined by organ disease, example Cardiology; Gastroenterology, Nephrology, Radiology, Oncology, General Surgery etc. The hospitalist, on the other hand is a "site defined generalist specialist" similar to ER physicians. They care for acutely ill patients with wide array of organ derangements and ages in a given specific location[7]. Hospitalist co-ordinate and integrate patient care within the health delivery system and reduce the distance between office and hospital with their round of clock availability. Hospitalists already have their own Clinical Textbook[8] and SHM is the fastest growing medical society in United States and soon plan to get credentials from ABME (American Board of Medical Specialties) to start an accredited fellowship program in Hospital Medicine.

## Critical Issues Facing Hospitalists today

There is significant variation in hospitalist's training level, and in the way hospitalists groups are managed. Starting a Hospitalist 'core curriculum' in Residency Training program is the key step towards this goal. Marshfield Clinic Internal Medicine Residents already do Hospitalist Service elective rotation for one month during their post-graduate training period at SJH. Funding of hospitalist programs remains a challenge for hospital administrators. Stagnant Medicare reimbursement, rise in uninsured patients, more acutely ill patients are increasing costs, while their ability to support these costs from hospital budgets is decreasing. There is increasing diversity of hospitalists clinical and non-clinical duties, 'burn out myth' due to ever increasing work-loads, rise in demand for hospitalists (1 available for 10 jobs!), perceived shortage may potentially compromising the efficiency and advantages of hospitalists[9]. Division between out-patient and inpatient practices continues to widen, hence it is vital to maintain connections between referring and primary care physicians. All of these may in-turn negatively impact hospiltalist and patient satisfaction[10].

Respondents (patients and allied health care providers) have overwhelming positive impressions of hospitalist movement. In

one survey over 76% believed that they improve Emergency Room efficiency, and 66% felt hospitalists' lower costs. Interestingly majority 69% would prefer hospitalists have additional certification or training. In 2007 at least 59% and probably closer to 2/3 of California Hospitals have hospitalists. I believe it's true for Wisconsin as well. Quality improvement, keeping patient's satisfaction (health care customer), challenging all the above critical issues discussed will be the key to success of this hospitalist program at St. Joseph's Hospital/Marshfield Clinic in future.

The impact of this revolution in Inpatient care is just beginning to be felt, and history will tell us if this is the best thing that has happened to medicine this decade. Nevertheless, hospital care will likely remain a highly pluralistic system in which organization of care is determined by efforts to improve the value of care in context to local demands and needs[11]. I am sure everybody will agree that, method of care chosen should always be the one that promotes the best clinical outcomes and highest patient satisfaction at lowest costs. With these goals hospitalists will definitely have increasingly visible role in many institutions across the country in near future.

**COMPETING INTERESTS**
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Review Article

# Bullying: a growing workplace menace

**Minal Mistry and Javed Latoo**

*"Those who can, do; those who can't, bully"* [1]

Bullying in the workplace is emerging as a problem over the past decade. Despite the tendency for incidents of bullying to be underreported [2] it is widespread in all sectors of the workforce including healthcare in the United Kingdom (UK) [3]. The culture of bullying in medicine contributes to this pattern of bullying behaviour that can adversely affect any aspect of working life from an employee's health [4] to the reputation of the organisation [5]. Therefore immediate changes are required to increase the recognition of this problem and take further steps to a solution.

## Bullying and harassment

There are different ways to understand the terms "bullying" and "harassment" but considerable overlap exists with similar patterns of behaviour (figure 1).

| **Figure 1: Examples of bullying and harassment [6]** |
|---|
| Spreading malicious rumours, or insulting someone by word or behaviour (particularly on the grounds of age, race, sex, disability, sexual orientation and religion or belief) |
| Copying memos that are critical about someone to others who do not need to know |
| Ridiculing or demeaning someone – picking on them or setting them up to fail |
| Exclusion or victimization |
| Unfair treatment |
| Overbearing supervision or other misuse of power or position |
| Unwelcome sexual advances – touching, standing too close, the display of offensive materials, asking for sexual favours, making decisions on the basis of sexual advances being accepted or rejected |
| Making threats or comments about job security without foundation |
| Deliberately undermining a competent worker by overloading and constant criticism |
| Preventing individuals progressing by intentionally blocking promotion or training opportunities. |

The essential difference between bullying and harassment is that the latter is usually a single incident that relates to ones social identity and is therefore viewed as discriminatory in nature e.g. racial or sexual harassment. In legal terms harassment refers to a course of conduct directed at a specific person, which causes substantial emotional distress, and can be identified by equality laws in the relevant country.

On the other hand workplace bullying is generally not covered by specific legislation. The exception to this is found in such as Sweden and Norway [7]. Indeed it is in Scandinavia where extensive research into bullying in the workplace originated [7].

## Bullying

Bullying in the workplace is known internationally by terms such as "mobbing, workplace harassment, employee abuse, mistreatment at work, and petty tyranny" [8]. There is no generally accepted definition of workplace bullying but it is summed up well by the following:

"Persistent, offensive, abusive, intimidating or insulting behaviour, abuse of power or unfair penal sanctions which makes the recipient feel upset, threatened, humiliated or vulnerable, which undermines their self-confidence and which may cause them to suffer stress" [9].

It is important to distinguish between bullying, which is always undermining and destructive, and constructive supervision that is developmental and supportive [8]. The three essential elements of bullying are that it has a negative impact on the victim, it is persistent and, crucially, bullying is subjective [10]. If a person feels bullied then he/she is being bullied [11]. This last point may be controversial because it is dependent on the bullied person's views and not based on "objective" evidence. Nevertheless workplace bullying exists as a problem. According to the Chartered Institute of Personnel and Development (CIPD) there has been a shift of perception in organisations from denying it happens to accepting that bullying is a problem [3].

## How common is bullying?

"The Silent Epidemic" [7]

Workplace bullying affects up to 50 per cent of the UK workforce at some time in their working lives and has an annual prevalence nearly 40 per cent [7]. One in 10 callers to the UK National Bullying Advice Helpline are health care professionals [3]. A questionnaire survey [12] revealed that 38% of staff in a

community healthcare trust were subject to workplace bullying in the previous year and that 42% had witnessed bullying of others. The British Medical Association (BMA) has acknowledged that bullying rates are higher in healthcare organisations and stated that 1 in 7 National Health Service (NHS) staff reported being bullied by other staff [13].

The scale of the problem has been widely highlighted as a problem in the nursing profession [10] with increased rates of bullying reported in Black and Minority Ethnic (BME) groups [14]. In doctors bullying may occur in the clinical, educational [8] and research environment [15]. One survey of doctors in the UK revealed that 37% of junior doctors had been bullied and 84% had experienced at least one bullying behaviour in the preceding year[16]. Higher rates have been reported in non-European Union (non-EU) doctors practicing in westernised countries [17] who are also less likely to take action against bullying [18].

Despite the growth of literature in this area the problem of workplace bullying is obscured by underreporting which has numerous causes (figure 2).

| **Figure 2: Reasons for underreporting of bullying [2]** |
|---|
| Fear it will make matters worse |
| The belief that nothing would be done about it |
| Concerns about confidentiality |
| Fear of possible victimisation |
| Concerns of being labelled a troublemaker |
| May be seen as an admission of failure |
| A degree of learned tolerance that may imply that the behaviour is acceptable |

The greatest fear is that of reprisals from the employer, associates of the bully, and powerful professionals, who may "close ranks" and compromise the career of the "whistle blower" [1].

## Why do people bully in medicine?

The antecedents to bullying have undergone considerable debate in the psychology literature. Bullies may be attracted to the caring professions to take advantage of the vulnerability embedded in them in relation to clients and employees [1]. However in most cases the bullying in medicine is likely to be unintentional and could be shaped by the power inequality in relationships (e.g. consultant Vs junior doctor) in the field.

Moreover the traditional hierarchy within medicine and the teaching by intimidation and humiliation may foster a culture of bullying [18]. Studies in the United States [19] and UK [13] have suggested that bullying commences with medical student and that this sets up a "transgenerational legacy" [7] as the behaviours of bullying are passed down. The BMA urges for a stop to the "cycle of bullying" and argue further that "the target ethos in the health service" with the "survival of the fittest" culture adds to bullying [13].

## How do you know if you are being bullied?

If you are being bullied early warning signs may be present. These include the perception that your working relationship is different, that you are being persistently "got at", that your work is being unfairly criticised, or you begin to question whether these mistakes you are supposed to have made really are your fault [20]. In addition to feelings of being undermined, or humiliated, bullying may also be associated with symptoms (figure 3).

| **Figure 3: Symptoms of bullying [20]** | |
|---|---|
| **Physical** | **Emotional** |
| Sleeplessness | Acute anxiety |
| Nausea | Feeling isolated |
| Migraine/severe headaches | Loss of confidence/self-esteem |
| Palpitations | Depression |
| Skin complaints | Panic attacks |
| Sweating/shaking | Anger |
| Stomach problems | Mood swings |
| Backache | Lack of motivation |
| Loss of appetite | Suicidal thoughts |
| Lethargy | |

## Why does bullying matter?

It is clear from the physical and psychological effects that bullying affects people in their personal health. Workplace bullying can also contribute to problems of staff retention and economy. Estimates suggest that in the UK bullying cost employers 80milion lost working days and up to £2-30 billion in lost revenue each year [7]. It costs the NHS more than £325 million a year and accounts for around 50 per cent of stress-related workplace illnesses [5].

Other effects of bullying at work include poor morale, poor employee relations, loss of respect for managers or supervisors, poor performance, lost productivity, absences, resignations, damage to organisation's reputation and potential costs in tribunal and other court cases [6]. Ultimately if the culture of bullying results in demoralized staff working, in a caring profession, it is the patients who will suffer.

## What is currently being done about it?

In the UK the BMA has called for zero tolerance on bullying [13] and have provided a report on bullying and harassment in the workplace [21]. Most NHS trusts disseminate anti-bullying policies, in connection with "Dignity at Work", but the effective implementation of these policies has been questioned with the criticism that it is "only for show" [18]. The information on guidance and policy, in relation to workplace

bullying, is not widely publicised and the question is whether bullying is being systematically played down?

## Recommendations

Although organisations such as the health service have taken steps to deal with bullying it is clear that problems persist. Heenan [5] states that an "all-singing all-dancing policy is worthless without a culture that believes in and supports it" and recommends steps employers need to consider (figure 4).

| **Figure 4: Key steps recommended for employers [5]** |
|---|
| Look at the culture of the organisation – where and how might the risk of harassment arise? |
| Foster an environment where staff feel able readily to raise any concerns, before they become problems. |
| To support this, have a clear and well publicised policy to tackle harassment issues. |
| Back this up with training (including how to handle grievances) and set good examples through role models. |
| Deal with harassment wherever and however it arises, to demonstrate that it is unacceptable and will not be tolerated. |
| Provide independent employee assistance, including confidential counselling and other support for employees to enable to challenge unreasonable behaviour which, left unchecked, could lead to harassment. |

| **Figure 5: What to do if you are being bullied [2]** | |
|---|---|
| **Steps to take** | **Options for support** |
| Approach, or write to, the bully and ask them to stop | Speak to a friend, colleague, supervisor or manager |
| Ask line manager, supervisor, human resource representative or trade union official to speak to the bully. | Ask employer for support from a specially trained staff member |
| Keep a record of any incidents and informal action taken | Speak to general practitioner especially if your health is affected |
| Consider a formal complaint in writing to their line manager or human resources representative | Seek counselling which has been provided by the NHS to its entire staff since 2000 |
| Have a colleague accompany you to any formal investigation meetings | Contact bullying and harassment hotlines |
| Formal investigation may recommend a disciplinary hearing | Employer may refer you to an external agency for more support |
| Alternative management action may be considered e.g. facilitated discussion or redeployment | Mediation may be on offer to encourage and help reach an informal outcome |

Awareness of bullying needs to be raised and the problem dealt with at an organisational and individual level. The authors suggest that bullying should be incorporated into teaching programmes and induction of junior doctors. Heenan [5] recommends training for managers and supervisors so that they have the confidence to deal with a situation, and deal with it at an early stage, rather then allowing the problem to accumulate and end up in the courts. Therefore it is in the healthcare trusts' interests to take these steps to monitor and manage this problem.

In addition employees in healthcare need to be better informed of what steps to take if they find themselves as victims of a bully at work. NHS employers provide options available to deal with bullying and provide support for it (figure 5).

## Conclusion

The late Tim Field, founder of the National Workplace Bullying Helpline, warns that everyone is at risk of becoming a target of bullying [1]. However the bully in healthcare organisations may not often realise what they are doing, so do both parties require help? There are conflicting views for the solution to bullying in the workplace regarding whether educational [22] or punitive [17] measures are appropriate. This will continue to be a matter of debate. Whichever approach is adopted, identification and increased awareness of bullying is the first step to the solution.

"Bullying is an old problem that keeps re-emerging without a clear solution" [3]

| **KEY POINTS** |
|---|
| Bullying is subjective – if you feel bullied then you are bullied |
| Bullying is more prevalent then we think because of underreporting |
| Causes of bullying are complex and may be embedded in the culture of the organization |
| Being bullied is associated with emotional and physical symptoms |
| Bullying has implications at a personal, social, and organisational level |
| Implementation of policies by health care trusts need to be improved |
| Organisations need to be more proactive in raising awareness of this growing menace and demonstrate that it is unacceptable |

## Useful UK online resources

- http://www.acas.org.uk - Advisory, Conciliation and Arbitrary Service
- http://www.andreaadamstrust.org - Non-political non-profit making charity focussing on problems caused by workplace bullying.

- http://www.dignityatwork.org - A website for the Dignity at Work Partnership – the world's largest anti-bullying project.
- http://www.jfo.org.uk - "Just Fight On" is a non-profit making anti-bullying organisation.
- http://www.workplacebullying.co.uk - a non-profit site providing legal resources to those fighting against workplace bullying.

**COMPETING INTERESTS**
None Declared

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Original Article

# Assessment of different concentration of Ketofol in procedural operation

**Mohamed Daabiss, Medhat Elsherbiny and Rashed AlOtibi**

**Abstract**

Propofol is an IV anesthetic that is often used as an adjuvant during monitored anesthesia care, the addition of ketamine to propofol may counteract the cardiorespiratory depression seen with propofol used alone. Ketofol (ketamine/propofol combination) was used for procedural sedation and analgesia. However, evaluation of the effectiveness of different concentrations of Ketofol in procedural operation regarding changes in haemodynamics, emergence phenomena, recovery time, the doses, and adverse effects was not yet studied, so this randomized, double blinded study was designed to compare the quality of analgesia and side effects of intravenous different concentrations of ketofol in hundred children of both sex undergoing procedural operation, e.g. esophgoscopy, rectoscopy, bone marrow aspiration and liver biopsy participated in this randomized, double-blinded study. Patients received an infusion of a solution containing either combination of propofol: ketamine (1:1) (Group I) or propofol: ketamine (4:1) (Group II). Subsequent infusion rates to a predetermined sedation level using Ramsay Sedation Scale. Heart rate, noninvasive arterial blood pressure (NIBP), oxygen saturation ($SpO_2$), end tidal carbon dioxide ($Etco_2$) and incidence of any side effects were recorded. There were no significant hemodynamic changes in both groups after induction. However, there was an increase in postoperative nausea , psychomimetic side effects, and delay in discharge times with the largest ketamine dosage (Group I). We concluded that the adjunctive use of smaller dose of ketamine in ketofol combination minimizes the psychomimetic side effects and shorten the time to discharge.

**Key words:** ketofol, procedural operation, psychomimetic effect.

Procedural operations, are procedures outside the operating room, which developed from a facilitation of diagnostic and therapeutic procedures into an independent subspecialty. Procedural sedation and analgesia is a minimally depressed level of consciousness that retains the patient's ability to maintain a patent airway independently and continuously[1].

Propofol is a short-acting intravenous sedative agent used for the induction and maintenance of general anesthesia for adults and children, sedation for intubated, mechanically ventilated adults in Intensive Care Units (ICU), and in procedures such as colonoscopy. It provides no analgesia(2). Ketamine is classified as an NMDA receptor antagonist and has also been found to bind to opioid μ receptors and sigma receptors. It induces a state referred to as "dissociative anesthesia"(3).

Ketofol (ketamine/propofol combination) was used for procedural sedation and analgesia. Ketamine and propofol are physically compatible for 1 hr at 23°C with no increase in particle content at Y site injection [4]. Ketamine and propofol administered in combination have offered effective sedation for spinal anesthesia and for gynecologic, ophthalmologic, and cardiovascular procedures in all age groups. The opposing hemodynamic and respiratory effects of each drug may enhance the utility of this drug combination, increasing both safety and efficacy and allowing reduction in the dose of propofol required to achieve sedation.

However, evaluation of the effectiveness of different concentrations of Ketofol in procedural operation regarding changes in hemodynamic, emergence phenomena, recovery time, the doses, and adverse effects was not yet studied, so this randomized, double blinded study was designed to compare the quality of analgesia and side effects of intravenous different concentrations of ketofol in children scheduled for procedural operations.

## Methods:

A hundred patients, American Society of Anesthesia (ASA) class I or II scheduled for procedural operation, ages 3 to 12 years were enrolled in this study. After obtaining approval from the local research ethics committee, all patients and their parents were informed about the procedure and the anesthetic technique and an informed written consent was obtained from each. Patients with clinically significant cardiovascular, respiratory, hepatic diseases or epileptic patients, longer procedures more than one hour and sensitivity to the drugs were excluded from the study.

Patients were randomized into two equal groups each of 50 patients going for procedural operation, e.g. esophgoscopy, rectoscopy, bone marrow aspiration and liver biopsy. Pre procedural visit was done to evaluate if that patient fulfils the criteria of study and for fasting instruction. In the preoperative waiting area, an IV catheter was placed after applying emla cream. Baseline measurements included Non Invasive Blood Pressure (NIBP), heart rate, respiratory rate, and pain faces scale which is recommended for children aged 3 years and older (Fig1)[5]. The level of sedation was determined by Ramsay Sedation Scale[6]. A separate observer who was blind to the drug

combination being used assessed the depth of sedation of such patients.

***Ramsay Sedation Scale[6]**
Patient is anxious and agitated or restless, or both
Patient is co-operative, oriented, and tranquil
Patient responds to commands only
Patient exhibits brisk response to light glabellar tap or loud auditory stimulus
Patient exhibits a sluggish response to light glabellar tap or loud auditory stimulus
Patient exhibits no response


**Fig 1: Pain Faces Scale.**

A propofol/ketamine admixture was prepared by an assistant who was not involved in the clinical management of the study patients. According to a prestudy randomization schedule of study group assignment, a ketofol (1:1): propofol 14.285 mg, ketamine 14.285 mg/ml by mixing 10 ml propofol 2% (20 mg/ml) with 4 ml ketamine (50 mg/ml) in group I, while in group II ketofol (4:1): propofol 18.1818 mg , ketamine 4.5454 mg/ml by mixing 10 ml propofol 2% (20 mg/ml) with 1 ml ketamine (50 mg/ml).

Both bolus and maintenance doses were given using syringe pump (B/Braun). Set up for delivery of Ketofol in both groups as an initial bolus of 600 µg/kg IV (calculated as dose of propofol in these infusions for simplicity), followed by an initial maintenance infusion at 100 µg/kg/min by anesthetist who was blinded to the identity of study infusion.The level of sedation was assessed at 1- 3 minutes intervals, and the initial infusion rate was adjusted (in 25 µg/kg/min increments) to achieve Ramsay Sedation Scale of 5 before starting the procedure.

During the procedure, patients were kept on oxygen nasal prongs with a $CO_2$ sampling port. All patients were monitored with NIBP, electrocardiography (ECG), Pulse oximetry($SpO_2$), heart rate (HR), and end tidal carbondioxide( $EtCO_2$). The measurement started before commencement of the intravenous (IV) line and continued five minutes after induction. The patients were also assessed for apnoea, which was defined as the loss of respiratory efforts for more than 20 seconds or fall of $SpO_2$ below 95%. Complaints of pain/discomfort were treated by an incremental increase in the study drug infusion rate.

The study drug infusion was discontinued at the end of the surgical procedure, and the total drug requirements were noted. After the completion of the procedure, patients were transferred to recovery room when an Aldrete score[7] 9-10 was confirmed, and kept there till ready for discharge. The recovery room nurses were blinded to the study medication received by the patients. The incidence of any episode of postoperative nausea and vomiting (PONV) or any other side effects (e.g. hallucinations, agitation or pain) was noted. The patients' vital signs were assessed at 5-min intervals. Patients were considered "ready for discharge" when they had stable vital signs, oriented, able to ambulate unassisted, had no intractable nausea or vomiting, and had minimal pain. Discharge times were determined from the time the study drug infusion was discontinued. Outpatients were given written discharge instructions regarding post-procedure precautions and a telephone number to use in case of emergency.

Descriptive variables were analyzed using Student's *t*-test and $X^2$ test as appropriate using SPSS software statistical computer package version 15. Differences between the groups in mean blood pressure (BP),heart rate( HR), end-tidal $CO_2$, oxygen saturation and ketofol requirements were compared using analysis of variance with repeated measures. A $P$ value < 0.05 was considered to be statistically significant. Values are expressed as mean±SD.

**Results:**

There were no significant differences among patients in both groups regarding number of patients, age, sex, weight, ASA physical status, and duration of ketofol infusion (table 1). There was 2 patients excluded in group I; one had a history of epilepsy and the other was acute lymphocytic leukemia on corticosteroids, while in group II only one patient was excluded due to history of epilepsy (Table 1).

Sedation scores were similar in both groups. The average ketofol initial dose in group I was 600 µg /kg followed by an average infusion rate of 116 ± 24 µg/kg /min, while in group II the average ketofol initial dose was 600 µg/Kg followed by an average infusion rate of 132 ± 36 µg/kg /min with a significant difference between groups ($P$ <0.05).

There was a minimal decrease in mean arterial blood pressure (MAP) from baseline in both groups following the initial dose of ketofol. Significant hypotension was noted in 2 patients in group I (4%) and in 3 patients in group II (6%) which was corrected by a bolus of Ringers solution 10 ml/kg IV. The diffrence between the groups was statistically insignificant . All the patients had increase in pulse rate compared to the baseline. The change was least in group II (p <0.05), but no patient had severe tachycardia requiring treatment in both groups.

There was increase in $Etco_2$ in both groups after induction with statistically insignificant difference between groups. Patients in both groups had decrease in arterial oxygen saturation ($SpO_2$) after induction. Five patients (10%) in group I and three patients (6%) in group II had apnea and hypoxia after induction ($SpO_2$ <95%). Excessive salivation was noted in 15

patients (31%) in group I but only two patients (4%) in group II. Eight patients (16%) in group I and two patients (4%) in group II experienced airway obstruction or apnea which required airway support. These changes were statistically significant between both groups.

**Table 1. Demographic Characteristics, Intraoperative Management, and Recovery Times of Patients in the Study Groups**

| | Group 1 | Group 2 |
|---|---|---|
| Number | 50 | 50 |
| Age (yr) | 6.6 ± 3.6 | 7 ± 3.1 |
| Weight (kg) | 21 ± 8 | 23 ± 7.5 |
| ASA physical status | (I–II) | (I–II) |
| Duration of infusion (min) | 25.3±12.4 | 23.8 ± 14.8 |
| Average propofol concentration (mg/ml) | 14.3 | 18.18 |
| Average ketamine concentration (mg/ml) | 14.3 | 4.54 |
| ketofol bolus dose (µg /kg) | 600 | 600 |
| Average Ketofol infusion rate (µg/kg /min) | 116 ± 24 | 132 ± 36* |
| Time to ambulation (min) | 15.4 ± 9.5 | 8.2 ± 6.7* |
| Ready for discharge (min) | 26.5±11.3 | 15.3 ± 8.4* |
| Time to actual discharge (min) | 38.8±13.5 | 28.2 ± 8.9* |

-Data are mean ± SD, median (range).
-Group I propofol/ketamine (1:1), Group II = propofol/ketamine (4:1)
-ASA = American Society of Anesthesiologists.
-Average bolus dose were calculated as dose of propofol in infusion. Average infusion rates were calculated as total drug (propofol) divided by weight and case duration.
* Significant difference ($P < 0.05$) versus group I.

Two patients in group II (4%) and one patient in group I (2%) had pain and discomfort during the procedure which was overcome by incremental boluses of infusions. In group I, one patient (2%) complained of postoperative nausea, four patients (8%) experienced bad dreams and hallucinations and five patients (10%) complained of agitations with no psychomimetic changes in group II

The time to ambulation in group I and II patients was 15.4 ± 9.5 and 8.2 ± 6.7 minutes respectively, while readiness to discharge was 26.5± 11.3 in group I and 15.3 ± 8.4 minutes in group II. The time to actual discharge was 38.8 ± 13.5 minutes in group I and 28.2 ± 8.9 minutes in group II. These changes in recovery timings were statistically significant.

**Discussion:**

The goals of procedural sedation are to provide an adequate level of sedation while minimizing pain and anxiety, maximizing amnesia, minimizing the potential for adverse drug-related events, controlling behavior, and maintaining a stable cardiovascular and respiratory status. A number of studies have demonstrated that the combination of ketamine and Propofol (ketofol) for sedation is safe and effective. The combination of the two agents appears to reduce side effects of each medication used alone, and allows for a rapid recovery time[1].

We compared the safety and efficacy of different concentrations of ketofol in procedural operations in children. The rate of ketofol infusion in group II was higher than in group I due to due to incremental doses of ketofol given to get the desired depth of sedation and abort pain sensation which was due to less ketamine content in such infusion compared to group I. Propofol in the recommended dose of 2-2.5 mg/kg almost always causes fall in blood pressure and the extent of fall depends upon the dose and adjuvant drugs used. Because we used an initial infusion dose of only 600 µg/kg, the fall in MAP was mild (6%) and similar in both groups. The induction doses of propofol are reduced considerably by combination with small doses of ketamine. Ketamine had the additional advantage of better hemodynamic stability. Our results are consistent with Furuya et al and Hui et al who suggested that the minimal change observed in arterial pressure may be dose related and also because sympathomimetic actions of ketamine were effective in counter-acting the hemodynamic depression of propofol. There was a trend for pulse rate to increase after the induction in all the groups, but there was no occurrence of profound tachycardia in any group[8,9].

Akin et al published a trial of 60 patients between one month and 13 years of age undergoing cardiac catheterization who received sedation with propofol or propofol plus ketamine (3:1). They found a significant (decrease in MAP in 11 patients in the propofol monotherapy group and three patients in the ketofol group. They concluded that the addition of low-dose ketamine to propofol preserved MAP without prolonging recovery or increasing the incidence of adverse events[10]. While, Goh et al published a 90 patients having a laryngeal mask airway (LMA) placed received propofol with either ketamine (5:1), fentanyl (1 µg /kg), or placebo normal saline. They found the ketofol group had a significantly higher systolic blood pressure than the other two groups. They concluded that ketofol provided equivalent LMA insertion conditions while maximizing hemodynamics and minimizing apnea[11].

End-tidal $CO_2$ increased slightly after induction in both groups. In agreement with our results, Mildh et al and Persson et al who reported that ketamine-induced sympathoadrenal activation may account for improved ventilation, also arousal secondary to the subjective side effects of ketamine (e.g., perceptual changes and anxiety) may also contribute [12,13]. Also our results have confirmed the previous reports of Frey et al and Badrinath et al [14,15], suggesting that the combination of a small-dose ketamine with propofol improves ventilation during sedation.

We expect that the apnea and desaturation recorded in group I (10%) was due to the excessive salivation complicated the higher dose of ketamine in this group which led to impaired breathing and required airway support in 16% of such patients. While apnea and desaturation which happened in group II could be due to the higher infusion rate of propofol in ketofol combination.

Willman and Andolfatto published a study of 114 patients requiring procedural sedation and analgesia mainly for orthopedic procedures were given a 1:1 mixture of propofol and ketamine. Transient hypoxia occurred in 2.6% of patients, out of them one patient required bag valve mask ventilation. Three patients had an emergence reaction, one of whom received midazolam. No patient had vomiting or aspiration. Procedural success rate in this study without the use of adjunctive medications was 96.5%. Median time until recovery was 15 minutes (range 5 to 45 minutes) [16]. Furthermore, Akin et al compared propofol to propofol plus ketamine (3:1) in 60 patients between one and 13 years of age undergoing auditory brainstem response testing. There were no cases of desaturation in the ketofol group, but in the propofol group 4/30 experienced desaturation and 6/30 had apnea. The authors concluded that the addition of low dose ketamine to propofol reduced the risk of respiratory depression and the need for repeat medication administration[17].

The incidence of clinically significant psychotomimetic effects was noted in the large-dose ketamine group (group I). This could be a dose-dependent interaction of the excitatory anesthetic ketamine with a pure central nervous system depressant, such as propofol [18,19]. There were no post procedural psychotomimetic symptoms recorded in group II. In addition, the patient's mood was significantly better in the recovery room and cognitive function recovered more rapidly in such group than those given higher dose of ketamine. Nagata et al and Mortero et al are coinciding with our results as they suggested that ketamine in sedative doses is associated with electroencephalographic activation. Furthermore, small-dose ketamine increases thalamic sensory output and arousal. Sedative effects of propofol may be partially antagonized by the arousal effects of ketamine[20,21]. While Akin et al in a trial of 40 adult patients undergoing endometrial biopsy, reported that the combination of propofol (1 mg/kg) plus fentanyl (1 µg/kg) was compared to the combination of propofol plus ketamine (2:1). Time to recovery was similar; however time to discharge was longer in the ketofol group secondary to the increased presence of adverse events including nausea, vertigo, and visual disturbances. These authors concluded that although both regimens seem safe, ketofol (2:1) had more adverse events leading to a longer time until discharge and had a lower overall patient satisfaction[22].

Badrinath et al, published One hundred female outpatients undergoing breast biopsy procedures under local anesthesia received an infusion of a solution containing propofol in combination with different doses of ketamine . The sedative infusion rate was varied to maintain a deep level of sedation and normal respiratory and hemodynamic functions. They reported that combination of propofol and ketamine (5:1) provides effective sedation/analgesia during monitored anesthesia care[15]. Our results suggest that our combination propofol and ketamine (4:1) was more suitable in procedural operations as Badrinath et al used their preferred combination (5:1) only in monitored anesthesia care and they supplement their sedation with local anesthesia infiltration.

In conclusion, propofol combined with ketamine (4:1) infusion for procedural operations contributed adequate sedation and analgesia without hemodynamic and respiratory depression or psychotomimetic side effects and appears to be a safe and useful technique for procedural operations in the ambulatory setting.

**COMPETING INTERESTS**
None Declared

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Original Article

# Photographic documentation of open fractures: A survey of current practice and proposed recommendations.

R Ahmad, SKM Annamalai ,SMY Ahmed, SA Joseph and M Bould

**Abstract**

The primary objective of this survey was to check the availability and use of cameras in documentation of open fractures in emergency departments in England, Wales and Scotland. We also checked the use of mobile phone cameras in emergency departments without cameras. A telephone questionnaire posed questions to the first on-call orthopaedic doctor about the availability of a functional camera in the emergency department. Altogether, 102 doctors replied in 115 hospitals that were surveyed. Only 63 emergency departments had a camera available for photography of open fractures, in which 53 orthopaedic doctors would always take photographs of an open fracture. In 7 emergency departments a mobile phone camera was used for documentation of open fractures, as a camera was not available.

Subsequently, recommendations for wound documentation using a mobile phone camera have been proposed as it is easily accessible and portable with good picture quality that can be transmitted to offsite senior colleagues for advice. This would prevent wound infection and also act as an adjunct to a narrative description of the wound.

Open fractures are quite common and account for a considerable number of admissions to the emergency department with a frequency of approximately 23 per 100000 patients per year[1]. Infections of open musculoskeletal injuries, especially open fractures, continue to pose a challenge to the Orthopaedic and Trauma surgeons. To reduce the risk of nosocomial infections these wounds need to be instantly photographed before the application of a sterile dressing which has to be left undisturbed until the surgical intervention in the theatre[2].

The British Orthopaedic Association and British Association of Plastic surgeons recommend that a Polaroid photograph of every open fracture should be taken, this recommendation is not followed due to non availability of the equipment in some institutions[1]. This leads to unnecessary disturbance of the wound dressing, distress to the patient and nosocomial infection.

The objective of this study was to look at the availability and use of cameras in compound fractures in Hospitals across England, Wales and Scotland by using a telephone questionnaire.

## Methods

We randomly selected 115 NHS hospitals with A&E departments from all the regions of the England, Wales and Scotland using the www.specialistinfo.com website and selected every third hospital on the list. The survey was conduction by the means of a telephone questionnaire (Table 1); the questions were answered by the first on call Orthopaedic doctor. 89% (102/115) first on-call doctors answered the questionnaire.

**TABLE 1 Telephonic questionnaire**

| | |
|---|---|
| 1. Do you have access to a camera in the A&E? | Y/N |
| 2. If yes, is the camera available 24/7? | Y/N |
| 3. Have you found a functional camera available every time you have wanted to use it? | Y/N |
| 4. Do you always take a picture of an open fracture? | Y/N |
| 5. Do you think that a picture is a useful tool in the assessment of a wound? | Y/N |
| 6. If a camera is not available in the A&E do you use your mobile phone camera? | Y/N |

The questionnaire was meant to investigate if the doctor had access to a functional camera that was available round the clock in the Emergency department. It also questioned whether the doctor on call would always take a picture of an open fracture. They were also asked whether they thought that the picture was helpful in assessment of the wounds. Finally the respondents were asked whether they used a mobile phone camera in case of non availability of a camera in the emergency department.

## Results

Of the 102 first on call Orthopaedic doctors questioned, 38% (39/102) stated that they were unable to photograph an open fracture due to non availability of a camera in the emergency department. A functional camera was not available in both

trauma centers and small hospitals. Of the 61% (63/102) who had a camera available 22% (14/63) did not have 24 hour access to the camera. 33% (21/63) who have a Polaroid camera available have found occasions when they needed a camera but it was not functional. (Figure 2)

**Figure 1**

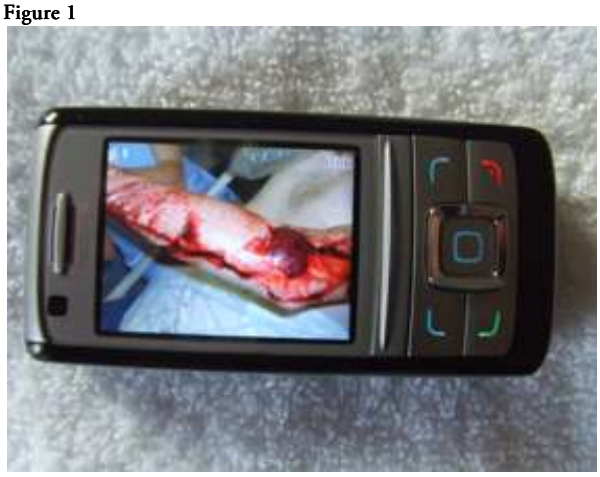
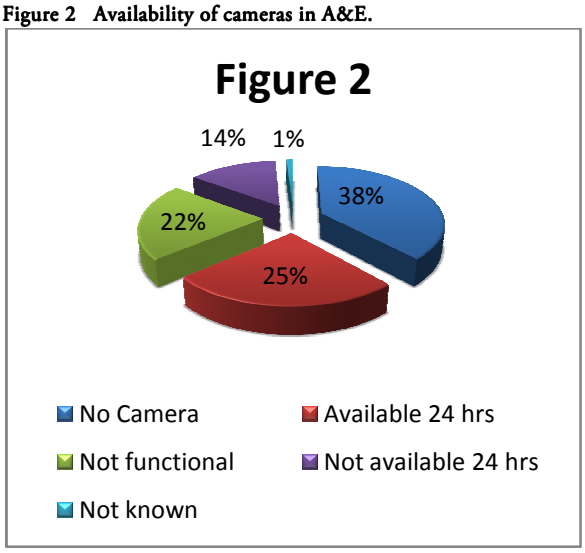


**Figure 2 Availability of cameras in A&E.**



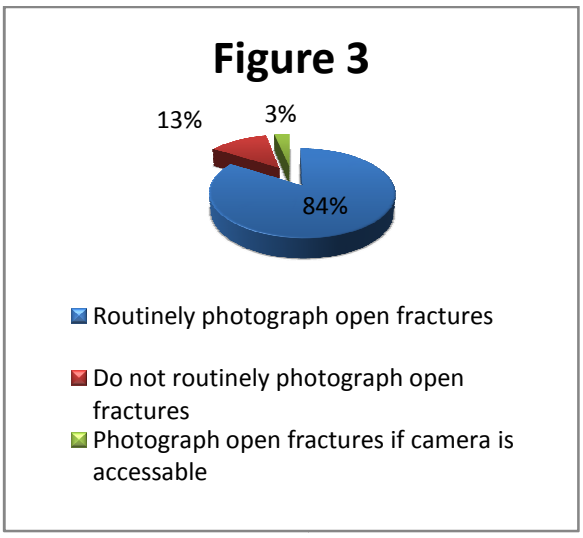

84% (53/63) who had a camera available said that they always photographed an open fracture. (Figure 3) 28% (11/39) doctors who did not have a camera in the emergency department would use a mobile phone camera to photograph an open fracture (Fig 1). 4 doctors used it even though they had a Polaroid camera in the Accident and Emergency department (A&E) as they found a mobile phone camera easy to use and readily accessible.

All the doctors who responded to the questionnaire thought that a camera was a valuable tool in the documentation of an open fracture.

## Discussion

The objective of this study was to look at the availability and use of cameras in compound fractures in hospitals across England, Wales and Scotland.

**Figure 3 Percentage of doctors photographing open fractures in A&E.**




We found that 38% of hospitals did not have access to a camera at all, in a further 15% there wasn't 24 hour access and another 21% had a camera that was not functional when needed at some time in the Emergency department. Thus 74% of hospitals did not have a functional camera available in the emergency department at all times. Therefore the photographic documentation of an open fracture as recommended by the British Orthopaedic association and the British association of Plastic Surgeons working party could not be implemented[2]. 13% (8/63) respondents who had a camera in the Emergency department did not routinely photograph an open fracture. A similar study done in London and south-east UK hospitals found that 10% hospitals did not have a camera to photograph an open fracture and another 19% did not have it available 24 hours[1].

The potential reasons for failure of photographic wound documentation could be difficulty to obtain funding for purchase of a camera, lack of secure storage space and unfamiliarity of the junior doctors with the guidelines of photographic wound documentation

Open wounds of the musculoskeletal system are usually contaminated at presentation with pathogenic organisms[3]. In the A&E the wound should be assessed and dressed until the formal debridement in the theatre. The ideal practice is to photograph the wound before application of the sterile dressing. These photographs are a vital tool as they act as an adjunct to a narrative description allowing the wound to be accurately described to colleagues. This avoids unnecessary disturbance of the sterile dressing over the wound which has a risk of nosocomial infection[2].

The problem of non availability of Polaroid cameras in the emergency department can be overcome by using mobile phone cameras. We faced the same problem of non availability of a camera in our A & E department and we started using our camera phones for photographing open fractures. The authors

found that images on mobile phone cameras allowed a useful presentation in the morning trauma meetings. The incidence of re- examining of the wound by the senior surgeons also dropped significantly. Mobile phones can be used in A & E as the maximum distance at which any phone causes interference is only two meters[4].

We found the mobile phone camera a valuable alternative as it is easy to use and has excellent portability with an image quality that is sufficient for interpretation. In our study it is already being used by many doctors in different hospitals. With the advancement in technology the mobile phones have become more user friendly with the power to process medical images[5]. The advantage over a Polaroid picture is that these images can be transferred to another mobile phone or sent as an e-mail attachment for assessment by the offsite registrars and consultants for immediate advice. This is even more useful in hospitals with hospital at night where second on call doctors are usually nonresident. It has been shown that it takes only 3-4 minutes from image taking to remote reception[6]. The Integrated Service Digital Network (IDSN) used for image transfer in some hospitals is expensive and mobile camera phones are a suitable inexpensive substitute.

We recommend supplying a mobile phone camera to the on call doctor. Unlike Polaroid cameras they don't need a constant supply of batteries and expensive film and the risk of theft is negligible as they are smaller, lighter with excellent portability. The picture can be magnified and is easier to store than traditional cameras. Images must be stored in a manner that prevents tampering and preserves confidentiality. This could be done by deleting the images after they have been assessed, hard copies produced and kept in the case notes as done with pictures taken with a Polaroid camera or storing them by using specific software packages that do not allow image manipulation7 .

There have been two studies assessing the accuracy of the use of mobile phone cameras in diagnosing intracranial pathologies and interpretation of emergency Ear Nose and Throat (ENT) radiological investigations. [5, 8] They have also been used to take pictures of injured digits and then transmitted to camera phones of plastic surgeons for assessment [6]. Tsai et al. in their study on teleconsultation by using the mobile camera phone showed that the camera phone is valuable for remote management of the extremity wound[9] .Lam TK et al. showed that low cost and the ease of use make the mobile camera phones easily incorporated into clinical practice[10].

## Conclusion

A functional camera was not available at all the times for photographic documentation of open fractures in the majority of the hospitals. We also feel that mobile phone cameras may be used as a powerful graphic adjunct to a verbal clinical presentation to other health professionals located on or off site.

**COMPETING INTERESTS**
None Declared

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Original Article

# Biochemical Study of Antioxidant Profile in Acute Ischemic Stroke

**Srikrishna R and Suresh D R**

**Abstract**

BACKGROUND : The present study was designed to measure changes in markers of antioxidant capacity (measured individually and total) following acute ischemic stroke.

METHODS : The study included 135 subjects. 62 were controls and 73 were ischemic stroke patients diagnosed clinically and by CT scan of the brain. The cases were divided into two groups, The ischemic stroke patients with large vessel / cortical, subcortical infarcts (Group. I) and small vessel / lacunar infarcts (Group. II) based on CT scan of the brain. Serum vitamin E, vitamin C, superoxide dismutase, uric acid and total antioxidant capacity were estimated in all the subjects.

RESULTS : Group I and Group II ischemic stroke cases had significantly lower levels of vitamin E, vitamin C and superoxide dismutase and significantly higher levels of uric acid compared to controls. The group I ischemic stroke cases had significantly lower levels of vitamin E, vitamin C, and superoxide dismutase and significantly higher levels of uric acid than group II ischemic stroke cases. Total antioxidant capacity strongly correlated with serum uric acid in cases

CONCLUSION: The present study suggests that estimation of vitamin E, vitamin C, SOD, uric acid and total antioxidant capacity may be used as an indirect evidence of oxidative stress induced neuronal damage in acute ischemic stroke which may be useful for monitoring and optimizing antioxidant therapy.

KEY WORDS: Stroke, oxidative stress, SOD, vitamin C, vitamin E. Total antioxidant capacity.

Several studies provide evidence of an association between ischemic stroke and oxidative stress. Increased free radical formation together with a reduced antioxidant defense causes oxidative stress, that may play an important role in the pathogenesis of stroke associated neuronal injury. Several studies demonstrate increased oxidative damage to neuronal cells during cerebral ischemia and reperfusion. Antioxidant activity is known to reflect the altered redox balance of affected fluids, tissues or organs in acute ischemic stroke patients. Therefore antioxidant concentrations or measures of their activity have been used to estimate the amount of oxidative stress [1]. No single component of serum antioxidant complex could fully reflect the protective efficiency of blood, probably because of interactions that occur *in vivo* among different antioxidant compounds. Total antioxidant capacity considers the cumulative effect of all antioxidants present in blood and body fluids [2]. The aim of this study was therefore to measure changes in markers of antioxidant capacity (measured individually and total) following acute ischemic stroke.

**Materials and methods:**

This study was conducted at Bapuji Hospital and Chigateri General Hospital, Davangere (Both Hospitals attached to J.J.M. Medical College, Davangere, karnataka), by including 62 healthy controls (of which 34 were men and 28 were women aged between 36 and 73 years) and 73 cases clinically diagnosed as acute ischemic stroke patients of less than 48 hrs duration after the onset of symptoms) and confirmed by computerized tomography of the brain (of which 41 were men and 32 were women aged between 36 and 73 years). The cases were divided into two groups, The ischemic stroke patients with large vessel / cortical, subcortical infarcts (Group. I) and small vessel/lacunar infarcts (Group. II) based on CT scan of the brain. The stroke patients due to cerebral hemorrhage, malignancy, sepsis, severe medical or psychiatric illness, language disorders, swallowing difficulties, cognitive impairment, gout, renal failure and patients who were taking antioxidant vitamins were excluded from the study. The study was conducted after informed consent was obtained from them and the study has been approved by the ethical committee of the institution.

Under aseptic precautions about 6 ml of a non-fasting venous blood sample was collected from cases within 24 h following stroke onset and from healthy controls. Blood was collected in appropriate tubes and centrifuged at 3000 g for 15 min to separate plasma from red blood cells. The supernatant was stored at $4^0$ C until analysis was carried out.

Serum vitamin E was estimated by Baker and Frank method [3], Vitamin C by 2, 4 – DNPH method [4], SOD by Marklund and Marklund method [5], and uric acid by Henry Caraway method [6] and total antioxidant capacity (TAC) by FRAP assay method [2] in both the controls and cases. All the chemicals used were of highest analytical grade available in India.

| TABLE I. Comparison of Serum Vitamin E, Vitamin C, SOD, Uric Acid and Total Antioxidant Capacity (Mean ± SD) | | | | | |
|---|---|---|---|---|---|
| | Vit. E mg/L | Vit. C mg/dl | SOD units/ml | Uric acid mg/dl | TAC (µmol/l) |
| Controls (n = 62) | 11.04 ± 0.97 | 1.16 ± 0.13 | 9.01 ± 1.03 | 4.66 ± 0.47 | 1079.7± 197.9 |
| Cases (n = 73) | 7.22 ± 0.81 | 0.52 ± 0.16 | 4.35 ± 0.70 | 6.56 ± 0.73 | 1043.4± 140.7 |
| Comparison | $p < 0.05$ | $p < 0.05$ | $p < 0.05$ | $p < 0.05$ | $p > 0.05$ |

| TABLE II. Comparison of Serum Vitamin E, Vitamin C, SOD, Uric Acid and Total Antioxidant Capacity (Mean ± SD) between Group I and Group II Cases. | | | | | |
|---|---|---|---|---|---|
| | Vit. E mg/L | Vit. C mg/dl | SOD units/ml | Uric acid mg/dl | TAC (µmol/l) |
| Cases Group. I (n = 56) | 6.93 ± 0.67 | 0.45 ± 0.08 | 4.14 ± 0.61 | 6.78 ± 0.62 | 1048.9 ± 140.3 |
| Cases Group. II (n = 15) | 8.24 ± 0.17 | 0.80 ± 0.10 | 5.12 ± 0.49 | 5.73 ± 0.55 | 1038.1 ± 142.9 |
| Comparison (one way ANOVA and student 't' test) | $p < 0.05$ | $p < 0.05$ | $p < 0.05$ | $p < 0.05$ | $p > 0.05$ |

**Statistical analysis :**

Statistical analysis was performed with one way ANOVA test, student "t" test and Pearson's correlation coefficient using SPSS version 16.0. A value of $p < 0.05$ was taken to indicate statistical significance.

**Results:**

It was observed that the serum levels of Vitamin E, Vitamin C, TAC and SOD were significantly lower in ischemic stroke cases than those of controls and serum uric acid levels were significantly higher in ischemic stroke cases [table I]. Further it was observed that the group I ischemic stroke cases had significantly lower levels of serum Vitamin E, Vitamin C and SOD than group II ischemic stroke cases and significantly higher serum levels of uric acid in group I cases than group II ischemic stroke cases [table II]. Significant negative correlations were observed between vitamin C, vitamin E, SOD and TAC and significant positive correlation was observed between uric acid and TAC among cases [table III].

| TABLE III. Correlations of Vitamin E, Vitamin C, SOD, Uric Acid with Total Antioxidant Capacity in cases. | | | | |
|---|---|---|---|---|
| | Vitamin C and TAC | Vitamin E and TAC | SOD and TAC | Uric acid and TAC |
| R value | -0.24 | -0.1 | -0.19 | 0.16 |
| p value | < 0.05 | < 0.05 | < 0.05 | < 0.05 |

**Discussion:**

In this study, there were reduced concentrations of vitamin E, vitamin C, SOD and TAC and increased concentrations of uric acid in stroke patients compared with controls. FRAP assay is presented as a novel method of assessing total antioxidant capacity [2] which is believed to be a useful measure of the ability of antioxidant present in the fluids to protect against oxidative damage to membranes and other cellular components..

Vitamin E, a potent chain breaking lipid soluble antioxidant, reacts with lipid peroxyl radicals eventually terminating the peroxidation chain reaction and thereby reducing oxidative damage. Some studies have shown reduced serum vitamin E levels in stroke patients and this may be due to high lesion volume resulting in production of more number of free radicals from a large ischemic injury. It is also shown that reduced vitamin E levels resulted in poor clinical outcome in stroke patients [7,8]. In the present study serum vitamin E levels were significantly decreased in ischemic stroke cases (significantly decreased in large vessel infarcts than in small vessel infarcts) when compared to controls.

Vitamin C represents the major water-soluble antioxidant in the human body. Many studies show that reduced vitamin C levels are associated with increased risk of both ischemic and hemorrhagic strokes [9]. In our present study the serum vitamin C levels were decreased significantly in ischemic stroke cases (decreased significantly in large vessel infarcts than in small vessel infarcts) compared to controls. It may be due to the exhaustion of this antioxidant in the neutralization of free radicals which are formed in excess during ischemia and reperfusion [10,11].

SOD is an endogenous antioxidant that catalyses the dismutation of the superoxide anion radical. SOD plays an important role in the defense against free radical damage in reperfusion injury and helps in reducing the infarct size during ischemia and reperfusion [12,13]. In the present study the serum SOD levels were decreased significantly in ischemic stroke cases decreased in large vessel infarcts than in small vessel infarcts) compared to controls.

Uric acid, most abundant endogenous aqueous antioxidant in humans, may protect against oxidative modification of endothelial enzymes and preserves the ability of endothelium to mediate vascular dilatation during oxidative stress [14]. Several studies have shown that increased oxidative stress is associated with high circulating uric acid levels due to elevation of xanthine oxidase in stroke induced brain damage [15,16]. In this

study, there was a significant increase in the serum levels of uric acid in ischemic stroke cases (increased significantly in large vessel infarcts than in small vessel infarcts) than in controls. Serum TAC strongly correlated with serum uric acid. Under multivariate analysis, serum uric acid explained most of the variance in TAC during the study period.

This study suggests that estimation of serum vitamin E, vitamin C, SOD, uric acid and total antioxidant capacity may be used as an indirect evidence of oxidative stress induced neuronal damage in ischemic stroke.

The limitations of our study are as follows: We have not estimated any markers of lipid peroxidation such as malondialdehyde which along with antioxidant levels would better explain oxidative stress. Antioxidant levels were measured only once, but prospective serial estimations would better predict the antioxidant status with prognosis of stroke. This study was conducted on a small group of stroke patients. Larger clinical studies in this area are needed to establish the relationships between antioxidant capacity and oxidative damage following ischemia and reperfusion in man, and to form the basis of appropriate antioxidant intervention strategies to minimize long-term brain injury following cerebral ischemia.

**COMPETING INTERESTS**
None Declared

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Case Report

# The 'Lost' Mirena: What Investigations Are Required ? An Intraperitoneal Levonorgestrel-Releasing Intrauterine System Following Uterine Perforation: Case Report

**Shambhu S and Pappas M**

The Mirena intrauterine system (IUS) has been licensed as a contraceptive in the UK since May 1995. Recent National Statistics suggest the Mirena IUS is used by only 1% of women aged 16–49 years who are currently using contraception.1 The Mirena IUS now also has a licence for the management of idiopathic menorrhagia2 and may therefore be used by women who do not require contraception. Uterine perforation is a serious, albeit rare, potential complication of intrauterine device or system use. Women may be informed that uterine perforation occurs in fewer than 1 in 1000 of either copper intrauterine device (IUD) or IUS insertions.3,4 Rate of perforation reported with the Mirena IUS in a large observational cohort study was 0.9 per 1000 insertions.5 In this case report, an intraperitoneal Mirena IUS was detected nearly 4 years after it's insertion and perforation of the uterus was diagnosed, despite vaginal hysterectomy and admissions to hospital. This case report demonstrates clearly that whenever there is suspicion from ultrasound scan report of an empty uterus that the IUS has fallen out, and in the persistence of symptoms, we should consider performing an abdominal X-Ray which is an easy, cheap method, to identify the IUS outside the uterus.

## Case report

A 33-year-old woman, para 2, with a long standing history of menorrhagia, dysmenorrhoea and tiredness was referred by her GP to the hospital (2002). At the time she was treated for anaemia and felt tiredness. Also she was suffering from dysmenorrhoea; her periods had been regular although in the previous few months she was bleeding PV continuously. Her periods had become heavy after sterilisation (1996). She was anaemic. Cervical cytology had always been normal. In the past she had undergone a laparoscopy for pelvic pain for suspected endometriosis (1997), an appendicectomy (1997) and she was diagnosed with duodenal ulcer (1996). For management of her menorrhagia, she opted for Microwave Endometrial Ablation which was done in August 2002. After that she had an ultrasound scan for erratic bleeding which showed irregular endometrium. The patient was booked for hysteroscopy under general anaesthesia. The procedure was attempted in September 2003 and was abandoned due to difficulties passing the hysteroscope through the endocervical canal. The hysteroscopy was repeated in January 2004 and few intrauterine adhesions were reported. A Mirena IUS was inserted under the same general anaesthetic.

A month later she was admitted to the hospital with right upper quadrant pain and a problematic bleeding pattern. Ultrasound at this stage showed a normal size uterus but the Mirena IUS was not obviously in situ. It was assumed the Mirena IUS had fallen out and the patient was booked for vaginal hysterectomy, which was performed in September 2005.

In January 2007 was admitted to the hospital with right upper quadrant pain again and all investigations including chest X-ray, abdominal ultrasound scan and blood tests were normal. She had an upper GI endoscopy which showed a gastric ulcer (Cardia).

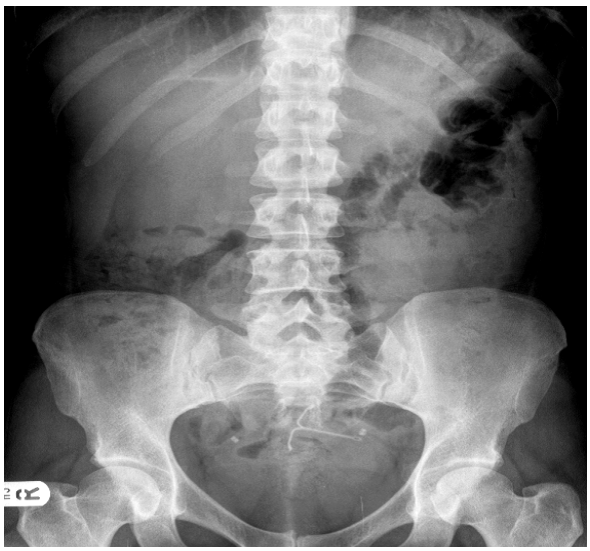

**Fig.1** Abdominal X-Ray with the Mirena IUS (arrowed).

She was admitted again 1 year later with pelvic pain. An abdominal X-ray showed the lost IUS (fig. 1) and the CT scan showed the IUS to lie anteriorly under the rectus muscles and adjacent to the dome of the bladder. In April 2008 the IUS was retrieved laparoscopically. The omentum was adherent to anterior abdominal wall and the Mirena IUS was found in the omentum, (Fig.2). This was felt to be unlikely to be the cause of the pain. The IUS was removed easily from the abdominal

cavity laparoscopically. The right tube and ovary were adherent to right pelvic side and they were freed up. The procedure was uneventful and the patient was discharged the same day and symptom free since.

## Discussion

Uterine perforation is a serious, albeit rare, potential complication of Intrauterine contraceptive use. For informed consent, women should be informed that uterine perforation occurs in fewer than 1 in 1000 intrauterine LNG-IUS insertions4

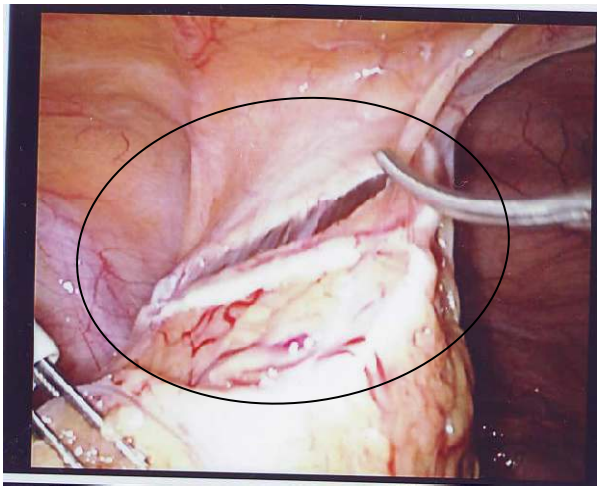

**Fig. 2** Mirena IUS (circled) within the omentum.

The rate of perforation reported with the LNG-IUS in a large observational cohort study was 0.9 per 1000 insertions.5 Current guidelines recommend that advice regarding the management of problems arising with the LNG-IUS use4 is similar to that for IUD use3. The problems are suspected perforation, 'lost threads', abnormal bleeding, pregnancy, presence of actinomyces-like organisms, pelvic infection, and postmenopausal removal.

The Royal College of Obstetricians & Gynaecologists recommends6 that women who present with persistent menorrhagia, despite LNG-IUS use, should be advised to return for further assessment of the uterine cavity (biopsy or ultrasound scan) to exclude pathology.

If menorrhagia persists despite medical treatments, women should be re-examined.6 An assessment of the uterine cavity should be performed using ultrasound scan. An endometrial biopsy should be considered in all women with persistent menorrhagia. When indicated, a hysteroscopy allows the assessment of the uterine cavity and biopsy under local anaesthesia.6 The WHO Selected Practice Recommendations for Contraceptive Use (WHOSPR) 7does not specifically refer to the Mirena IUS. Follow-up 3–6 weeks following IUD insertion is recommended and the Clinical Effectiveness Unit (CEU) advises similar follow-up for women using the Mirena-IUS.

In this case report, the detection of the Mirena IUS inside the peritoneal cavity was noted nearly 4 years after the insertion and the perforation of the uterus. The patient had several admissions to the hospital under the care of gynaecologists or gastroentero-logists always complaining for upper or lower abdominal pain. She even had a vaginal hysterectomy. Had she undergone an abdominal hysterectomy, the Mirena IUS may have been noted at that time.

This case report clearly demonstrates that following an ultrasound report showing an empty uterus in a symptomatic patient, an abdominal X-ray should be performed to identify whether or not the IUS is inside the peritoneal cavity. Also, we need to be aware of the peritoneal adhesion potential of Mirena IUS it is expected to be low. In another case report8, an intraperitoneal Mirena IUS resulted in plasma levonorgestrel levels 10 times higher (4.7 nmol/l) than the plasma level of levonorgestrel observed with Mirena IUS placed in utero. This high plasma LNG level suppresses ovulation. Therefore, aside from the adhesion potential, a misplaced Mirena IUS should be removed when pregnancy is desired9, 10.

The authors conclude that judicious use of the abdominal X-ray can lead to the early detection of a migrated IUS and expedite early removal.

A thorough literature search of the Medline, Embase and Cochrane databases did not reveal case reports similar to this and also did not report any formal guidance as to the use of the Mirena IUS device following endometrial microwave ablation, but we did find an article regarding insertion of Mirena IUS, after endometrial resection.11

Endometrial resection is a surgical method to manage menorrhagia. Intrauterine scarring may occur following treatment, but it is not known if the risk of uterine perforation is increased.

The Clinical Effectiveness Unit (CEU) responded12 recently that the British National Formulary (BNF)13 suggested that intrauterine devices (IUDs) should be used with caution in severely scarred uteri.

The United Kingdom Medical Eligibility Criteria for Contraceptive Use (UKMEC)14 recommends that if women have a distorted uterine cavity (any congenital or acquired uterine abnormality distorting the uterine cavity in a manner that is incompatible with IUD insertion), then the IUD or the levonorgestrel-releasing intrauterine system (LNG-IUS) should not be used (UKMEC 4).

A narrative review paper on treatment after hysteroscopic surgery suggests that an acceptable post-operative method of contraception after endometrial ablation is the LNG-IUS, as it

protects the endometrium and there is a high amenorrhoea rate.15 However, following successful endometrial ablation the uterine cavity is usually severely narrowed making insertion of IUS (or IUD) impossible and it would not normally be considered as an appropriate method in these circumstances. Significant bleeding would suggest failure of the procedure, and if IUS or IUD was to be considered it should only be done with hysteroscopic assistance by an experienced gynaecologist.

**COMPETING INTERESTS**
None Declared

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Case Report

# An Unusual Presentation of Left Ventricular Free Wall Rupture following a Silent Myocardial Infarction

**Andrew Peter Vanezis, Rehan Quadery, Mohammad Wasil and Mohammed Azher**

**Abstract**

Left ventricular free wall rupture is a serious complication of myocardial infarction (MI) with a mortality rate without intervention close to 100%. Its presentation is classically late following an MI but in some cases can present within 24 hours. There can be sudden overt clinical symptoms or it can present insidiously and therefore there must be a high index of suspicion. This report highlights the case of a gentleman with no prior history of ischaemic heart disease that presented with non-specific symptoms. A diagnosis of left ventricular (LV) free wall rupture near the atrial appendage, post MI was made and he was managed successfully.

## Clinical Presentation

We present the case of a 75 year old gentleman who collapsed suddenly whilst riding his bicycle. According to an eye-witness he was unresponsive & confused for a few minutes after the episode. Paramedics attended and brought him to the Accident and Emergency department at a local hospital and he was subsequently transferred to the Admissions Unit. Initially he was confused with no recollection of the collapse however his confusion abated after a short period of time.

He was normally fit and well, his only past medical history of note being chronic neck pain requiring simple analgesia and mild asthma requiring when necessary salbutamol inhalers. He was however a life-long smoker with a minimal alcohol intake.

On arrival to the hospital, the patient was conscious, oriented, afebrile and not in any pain. His Glasgow Coma Scale (GCS) was 15/15, pulse was 92/min, regular but weak and the right radial and femoral pulses were absent. His systolic blood pressure was 55mmHg in the right arm and 105mmHg in the left arm. The only other positive finding on examination was muffled heart sounds. Bloods were taken and results are shown in Table 1 with normal ranges given for reference (results within normal limits are not shown).

| | | |
|---|---|---|
| Random Blood Glucose | 16 mmol/l | *<11.1 mmol/l* |
| Troponin I (12 hour) | 6.16 ng/ml | *<0.04* ng/ml |
| WBC | 14.0 x$10^9$/l | *4-11 x$10^9$/l* |
| CRP | 179 mg/l | *<10 mg/l* |
| Hb | 10.9 g/dl | *13-18 g/dl (men)* |

**Table 1**. Blood results with normal ranges in italics.

In view of the high blood glucose and history of collapse, the patient was aggressively treated with insulin and intravenous fluids. However after receiving 2 litres of intravenous fluids, there was no haemodynamic response. An arterial blood gas on air was performed and the results are shown in Table 2 with normal ranges given for reference.

| | | |
|---|---|---|
| pH | 7.40 | *7.35-7.45* |
| $pCO_2$ | 3.0 Kpa | *4.7-6.0 Kpa* |
| $pO_2$ | 14.8 Kpa | *10.8-12.5 Kpa* |
| $HCO_3$ | 13.6 mmol/l | *22-28 mmol/l* |

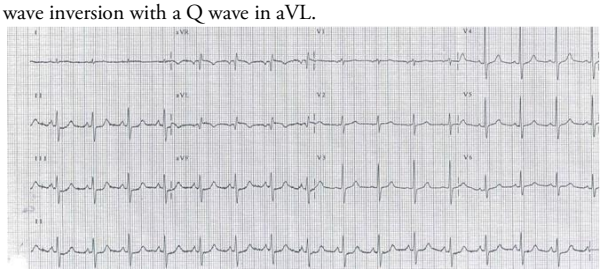
**Table 2**. Arterial Blood Gas with normal ranges in italics.

A Chest X-ray was performed and showed nothing unusual. However an ECG demonstrated ST depression in the inferior leads & T- wave inversion with a Q wave in aVL (see figure 1). Differential diagnosis at this stage was therefore aortic dissection, carotid dissection and left ventricular wall rupture (post myocardial infarction).

A subsequent CT scan showed no aortic dissection, but probable haemopericardium together with an occluded right common iliac artery (see figure 2). Trans-thoracic echocardiogram confirmed haemopericardium with no suggestion of tamponade (see figure 3) and in addition demonstrated some mild LV diastolic dysfunction. CT scan of the brain and the carotids showed no evidence of carotid dissection but did indicate significant stenosis of the right subclavian artery. The diagnosis of left ventricular free wall rupture was made at this juncture. It was noted that the variability in blood pressure between both arms and between upper limbs and lower limbs was exacerbated by coincidental stenosis in the right common iliac and right subclavian arteries which possibly delayed diagnosis.

Subsequent coronary angiogram showed a blocked intermediate coronary artery (a branch of the left main coronary artery), 2 stenosed areas in the left anterior descending coronary artery (LAD) and a 50% occlusion of the right coronary artery (RCA). Later a trans-oesophageal echocardiogram (TOE) demonstrated separation of the ventricular free wall between the LAD artery and the left atrial appendage, high up in the heart – a very unusual position indeed. The diagnosis of *Left Ventricular Free Wall Rupture following a Silent Myocardial Infarction* was therefore confirmed. The patient was transferred to a nearby cardiac surgery centre and an emergency patch repair of the ventricular free wall rupture was performed.

**Figure 1**. ECG demonstrating ST depression in II, III and aVL & T-wave inversion with a Q wave in aVL.



The patient had a prolonged recovery, spending 2 weeks on the Cardiac ICU and then subsequently developed hospital acquired pneumonia and remained an inpatient on a general medical ward for a further 4 weeks where he made slow progress. He later spent 4 weeks in a rehabilitation centre before finally returning home.

**Figure 2.** Thoracic CT with obvious haemopericardium.

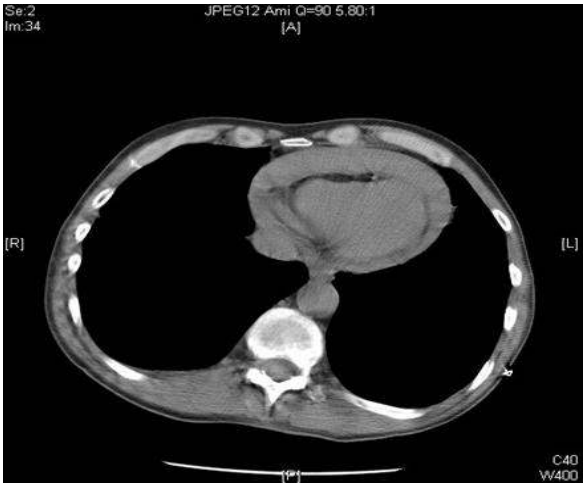
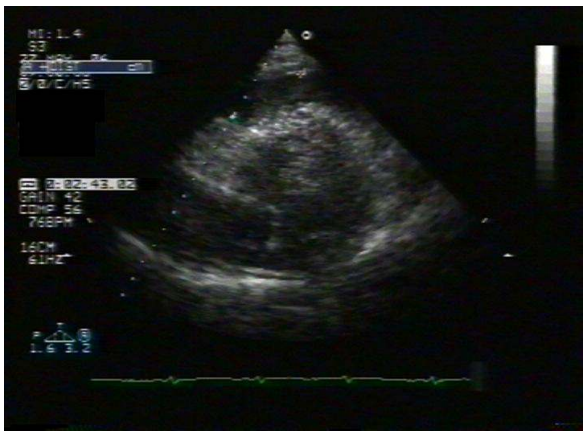



**Figure 3.** Transthoracic echo with evidence of pericardial fluid.

## Discussion

First described by William Harvey in 1647, left ventricular (LV) free wall rupture is a dramatic complication of myocardial infarction where there is a rupture of infarcted LV free wall tissue. The rupture is commonly insidious with bleeding into the pericardial sac and subsequent cardiac tamponade. It is hard to assess as clinical and autopsy results vary considerably. It contributes to nearly 15% of deaths due to acute MI[1], with the average age of those affected being 69 years. It is third only to cardiogenic shock and arrhythmias as the leading cause of death following a myocardial infarction.[2] Hutchins *et al* reviewed 153 post mortem results with gross and histological evidence of acute myocardial infarction and reported that 30.7% of patients in this group who had died from sudden death had a cardiac rupture.[3] It is more common in females and classically occurs 3 to 6 days post MI, however in some studies, up to 50% of cases have been reported less than 24 hours post MI.[4] There is a history of previous MI in 25% cases but often LV free wall rupture can be the first presentation of ischaemic heart disease.[5] Around 50% of the cases of LV free wall rupture are due to anterior MIs with LAD involvement.[6] There is a new murmur in 25% cases and echocardiography may often demonstrate a pericardial effusion. The prior use of NSAIDS and corticosteroids and a presentation which may mimic major artery dissection often delays thrombolytic therapy.



Unfortunately the current mortality rate in the UK is around 90%. Of note the incidence of LV free wall rupture post MI has increased since the more widespread availability of coronary care units and it is thought that this is because more people are now surviving the first few days post MI.[7]

The pathophysiological process involves thinning of the myocardial wall with the intensity of necrosis occurring at the terminal end of the vessel (watershed area) where there is often poor collateral flow. The shearing effect of myocardial contraction against a stiffened necrotic area causes rupture. The most common rupture location is on the anterior or lateral wall of the left ventricle.[8] A midventricular position along the apex to base axis is most common. It can present either with sudden death or can present sub acutely e.g. with nausea, hypertension or pericardial type chest discomfort or pain. The gentleman discussed in this report collapsed with no preceding symptoms and as mentioned the location of his rupture was in a very unusual place, high up near the atrial appendage.

Transoesophageal echo (TOE) is diagnostic for this condition and is the gold standard.[9] However it is found to have only a 70% sensitivity rate for LV free wall rupture[10] and therefore some centres advocate the use of cardiac MRI when available.[11] Initial management is haemodynamic stabilization and this is often followed by blood transfusion, pericardiocentesis[12], inotropic support and the use of an intra-aortic balloon pump but ultimately prompt surgical repair is required.

Various surgical techniques have been applied including suturing of the infarcted ventricle but modern surgical repair involves the application of a Teflon felt patch over the ruptured area with a synthetic biocompatible glue (e.g. cyanoacrylate) as an adhesive to keep the patch attached to the epicardium.[13,14] Crucially it can be performed without the use of cardiopulmonary bypass in most of cases. The current overall operative mortality for surgical intervention is reported to be around 24-35%[15].

Ultimately survival depends on early recognition of the condition, prompt investigations & diagnosis and urgent surgical treatment. Unfortunately at the present time the condition is usually diagnosed at post-mortem.

## Conclusion

The patient's presentation i.e. collapse with no proceeding symptoms coupled with the fact that he was suffering a silent MI with no prior indications of ischaemic heart disease e.g. angina, shortness of breath etc and the rapid subsequent development of left ventricular free wall rupture in such an high position made this quite an unusual case. Stenosis in the right common iliac and subclavian arteries did delay diagnosis slightly, as aortic and carotid dissection had yet to be ruled out but ultimately this patient survived probably because of early diagnosis despite these obstacles and subsequent prompt treatment.

**COMPETING INTERESTS**
None Declared

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Case Report

# A case of bilateral swelling of the hands in an elderly gentleman

**Vijay Joshi, Anna Green and Jane Griffin**

**Abstract**
Remitting seronegative symmetrical synovitis with pitting edema (RS3PE) is a rare clinical syndrome, commonly seen in elderly patients who present with dorsal pitting edema of the hands and has a dramatic response to steroids, suggesting a benign nature. Sometimes it is associated with other rheumatologic conditions and potential underlying malignancy should be ruled out, especially when there is a poor response to steroids.
**Key words ;**
Symmetrical synovitis, seronegative arthritis, PMR, paraneoplastic arthritis

Elderly patients presenting with musculoskeletal symptoms such as painful, swollen or stiff jointsare challenging to physicians. The common conditions encountered are osteoarthritis, crystal arthropathies, spondyloarthropathies and rarely seropositive arthritis. RS3PE highlights a different inflammatory disease involving the tenosynovium of the tendons of the hands with a characteristic presentation. This case details such a presentation and aims to raise awareness amongst general physicians.

**Case report:**

An 83 year old man, with a history of chronic leg ulcers and poor mobility presented following a fall.at home. On admission he also complained of a six to eight week history of bilateral hand swelling. This was of sudden onset, initially on the right hand and gradually progressed until the time of admission when it became prominent over the dorsum of both hands. Both hands were initially tender, but painfree at rest, and restricted in movement due to the swelling. Lately he had also noticed mild inactivity stiffness in his knees and shoulders, He had no previous musculoskeletal history, no skin rash or trauma to his hands.

Inspection of his hands revealed bilateral, symmetrical swelling, involving all the fingers and more pronounced on the dorsum. On palpation there was pitting oedema over the dorsum without signs of synovitis or joint deformity.(Figure 1 and 2).

On movement, finger flexion and opposition were limited, with reduced grip strength.

There was no girdle muscle weakness or pain. There was pitting oedema of both feet, with compression bandaging to the upper calf. This was chronic, and was likely to be secondary to peripheral vascular insufficiency.

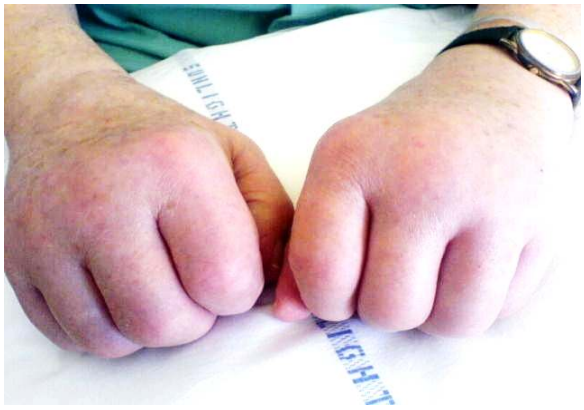

Fig 1:Swollen hands

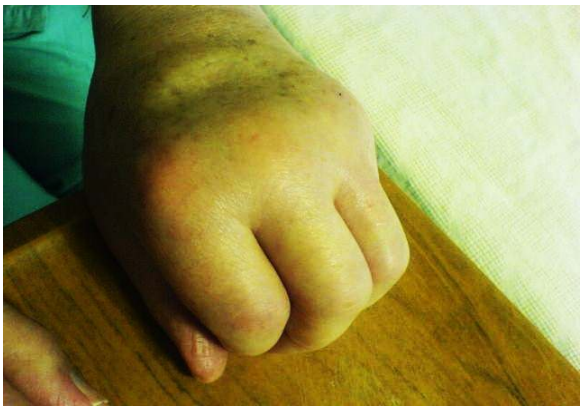

Fig 2: Dorsal pitting edema

Blood tests during this admission showed normocytic anaemia with low vitamin B12 levels but normal ferritin. Erythrocyte sedimentation rate (ESR) was raised at 100mm/hour and initial C-reactive protein (CRP) at 55 mg/l. Anti nuclear antibody (ANA) and rheumatoid factor were negative. X-rays of the hands revealed mild osteoarthrosis without any evidence of bony erosions. Computerised tomography (CT) of the chest and abdomen did not show any evidence of malignancy.

In view of the clinical presentation and seronegativity, a diagnosis of peritendinous rheumatoid arthritis was considered. He was commenced on low dose oral steroids following initial parenteral corticosteroid. Subsequent to the initiation of steroids, there was dramatic resolution of the swelling of the hands, within a week (Figure 3),

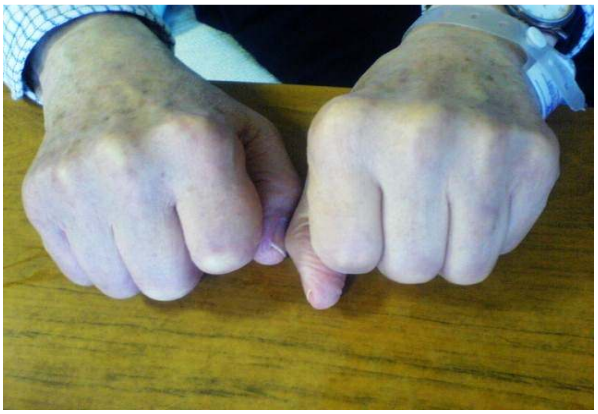

Fig 3: Response to steroids

**Case discussion**

Remitting seronegative symmetrical synovitis with pitting edema (RS3PE) syndrome was first described by McCarty et al in 1985 [1] . It is also termed as peritendinous rheumatoid arthritis in Europe.

It predominantly affects elderly males and although not exceptionally rare, there is no clear documentation of the incidence of this condition (2).

The syndrome is a subset of symmetrical polyarthritis characterised by

1. Bilateral pitting oedema of both hands
2. Sudden onset of polyarthritis (A few cases report patients being able to state the time to the hour at which this occurred.[1])
3. Age >50 years
4. Absence of rheumatoid factor (seronegativity).

Other features include symmetrical distal synovitis and tenosynovitis affecting the synovial sheaths of the flexor and extensor tendons of the hands and/or feet without evidence of joint erosions [2.] It responds dramatically to corticosteroids with long term remission after withdrawal, suggesting a benign prognosis.

Although generally thought to be a characteristic benign syndrome with good outcomes, several studies have been published linking RS3PE to various rheumatic disorders such as spondyloathropathies, psoriasis (HLA associations), polymyalgia rheumatica, and temporal arteritis. [3] It may also be a paraneoplastic manifestation of haematological or solid malignancies [4] (eg. prostate, rectal, gastric and ovarian tumors) linked to the synthesis of interleukin, IL-6. Review of these cases suggested that RS3PE associated with neoplasia was associated with a poor response to steroid treatment. [4]

Although MRI scanning offers the best imaging technique to diagnose the condition.,RS3PE is a clinical diagnosis. Scans typically demonstrate the tenosynovitis of the extensor tendons believed to cause the oedema which characterises the syndrome.[3] MRI scans are valuable to exclude other bony pathologies like osteomyelitis.. An alternative imaging technique for identification of extensor tenosynovitis is ultrasonography. [5]

Treatment generally involves steroids, but in some cases the patient may respond to NSAIDs or gold therapy

**Learning points:**
RS3PE should be considered as a diagnosis when a patient presents with bilateral symmetrical pitting oedema of the hands and or feet, and is found to be seronegative.
Patients are generally very responsive to corticosteroids.
A high index of suspicion is needed to search for underlying malignancy especially in the absence of associated rheumatic disorders and poor response to corticosteroid therapy.

**COMPETING INTERESTS**
None Declared

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Viewpoint

# Mal-distribution of Medical manpower resultant decay of the Indian medical education system: Existing problems and possible solutions

**Vallyamma P, Deshpande SR and Gayathree L**

**Abstract**

Indian medical education system has seen rapid growth in the last two decades. From a miniscule number, private medical colleges have grown to account for more than half of the 270 medical colleges in 2008 and consequently, India has the highest number of medical educators in the world. This unregulated unequal growth brings two issues to focus: the failing quality of medical education and implementing effective solutions to address an artificial faulty shortage due to doctor mal-distribution. The menace posed by the growing merchandisation of medical education has to be warded off and efforts should be made to ensure maintenance of standards and check the unplanned growth of substandard medical colleges and substandard education norms in universities or their constituent medical colleges. There is a strong case for a review of the entire system of medical education and examinations in the country. Some solutions like increasing retirement ages of MD faculty to 70 years, sharing of faculty, increasing MD seats, allowing clinical MDs to teach paraclinical and preclinical subjects or temporary merger of specialities have been proposed to address the faculty shortage instead of relying on inadequately qualified MSc non-medical faculty.

**Keywords:** Qualified Medical teacher, India, medical colleges, faculty shortage, Medical Council of India (MCI).Abbreviations DCI=Dental Council of India. MSc=Master of Science

Establishing a medical college is not similar to establishing a science or Arts College and apart from a huge capital requires a huge number of qualified, competent, MCI compliant manpower to produce quality doctors.[1,4,7] Having established a Medical College, maintaining the standards of education to world acceptable levels with a vision to serve poor Indian masses has been a concern of the Indian planning committees. Also, the good name a college attains is due to the accomplishments of its faculty and alumni. In that regard, proper emphasis on the quality of medical education ,inspite of the recent rapid proliferation of private medical colleges, has rightly been the working domain of Medical Councils all over the country and has consumed energies of Medical Council of India over the last forty years. [1, 4, 7 ,10,12]

The Medical Council of India (MCI), the regulatory and advisory body on medical education, approves medical curricula and permits medical school existence and allows for recognition of medical degrees issued by various universities. The accreditation process for medical schools focuses largely on the infrastructure and human resources required and little on the process and quality of education or outcomes.[15] The implementation of the recommendations of MCI regarding recognition or de-recognition of a medical college is governed by the Ministry of Health and Family Welfare, whilst individual universities also have variable sets of regulations for their affiliated medical schools. As a result, there is no uniformity in the standard of medical education across the country. At the time of independence there were just 19 medical schools with an output of 1200 doctors.[10] In 1965, there were 86 medical colleges in India with only a few private colleges[7] The college total increased to 112 by 1980(at a rate of 30%), to 143 in next decade (rate of growth of 28%) and since 1990 over past 18 years the number has increased to 271, an increase of ~90% compared with the figure in 1990.[7] Today, there are 271 medical colleges out of which about 31,000 medical graduates pass out every year and private sector medical colleges have grown to account for more than half of all medical education institutions in India [13]

Evidently, medical education system seems to have had an unregulated growth over the last two decades. It has been pointed out that even the prestigious colleges' window dress faculty lists or put up names of non-existing academic members in their staff list. [5] Most medical college permissions were gifts given out as largesse or patronage to political heavyweights from health ministry.[1,14] Very few have had adequate space, laboratories or hospitals as per MCI norms. They were and remain ill- equipped and inadequately staffed.[10] This unregulated rapid growth in enrolment of medical students and poorly implemented regulations relating to admissions, faculty strength and infrastructure in medical colleges adversely impacts quality of training in India's medical institutions.

Many reputed physicians and surgeons, professors, directors and deans working in new private medical colleges fabricate and falsify records like even birth records and lie to the MCI and the courts in order to get their medical college of questionable

standards approved or recognized. Illegal money is involved in the business of getting new private medical colleges approved or recognized by the MCI and the health ministry. The decay of medical colleges reflects the general trend in this country .[4,5] Corruption and bribery have made permanent inroads into medical education since past few decades in health universities or entrance examinations. Even clerks in the universities leak question papers and manipulate marks. [1] Perhaps the worst kind of gross unethical practice in academic medicine happens around the time of inspection by the Medical Council of India (MCI) post 1998-2000, in new private medical colleges. In emergency-like frenzied two day shows, busloads of patients are mobilized to fill up empty wards, carloads of doctors are paraded before the inspectors, and even instruments are hired or shifted between colleges, during the period of MCI inspections.[4]

Privatization in general has been known to increase the gap between rich and poor, amounting to encouraging survival of the richest which cannot be a acceptable goal of any civil society.[8] And, the policy of excessive privatization of medical care delivery system has undermined health services and further limited the access of the underprivileged.[3,8]

Privately, many managements agree that it is very difficult to get faculty and that it is even more difficult to retain them in the wake of continuous offers or lure from newly established medical colleges. Certain medical college locations in smaller cities or semi-urban areas do not have facilities, ambience, or charm of big cities hence attracting teachers or other qualified staff to such medical colleges has been difficult, and various inducements have been applied. Such colleges have been surviving council inspections by window dressing or luring faculty with money. In certain new colleges which are literally brick fresh, bereft of hostel or quarters or other amenities the teachers delay even more to move or settle down themselves. At times doubts are established whether an impossible set of conditions and heavy financial burden is imposed on Medical college managements, by the MCI just to make management fail MCI inspections, but at the same time, some stringent MCI regulations have helped faculty of Medical colleges by ensuring job availability.

Doubling of medical colleges over last 15 years has improved the number of medical practitioners in India, but will the mere increased numbers mean a higher quality health care delivery system is debatable. Most management fail to fulfill the excellent set of norms stipulated by Medical Council of India. It is worthwhile, in national interest to note that, we have been loosing medically qualified post graduates to Western countries since till recently Medical College teaching jobs were low paid and did not give that richness or respect attained by private practitioners. After the Karnataka Government & Pondicherry scales new implementation in 2007, with a heavy Non Practicing allowance teaching profession has gained respectability vis-à-vis elite in society like software engineers. Similar uniform pay scale implementation is need of the hour, all over the country to prevent medical teacher mass migrations.

Nearly 27000 teachers are required as per Ananthakrishnan's calculations [7] to fill the faculty positions in 270 medical colleges purely for the purpose of teaching MBBS.He ignores the existence of ~300 Diplomate National Board hospitals across India and requirement of faculty for DNB courses. He also ignores MCI recognized institutions exist in other countries like China, Nepal, Malaysia, Netherlands and have been training MBBS doctors of Indian origin. All these institutions have been drawing medical teachers to satisfy MCI or DNB stipulations for accreditation. Hence we have to account loosing faculty to such Institutions. Also his manpower calculations are only for colleges purely teaching MBBS and ignore multiple course Colleges like KMC Mangalore, Manipal which harbor 90 MSc students per year per department and ignores existence of PhD students which evidently will require more teachers. He also ignores the net strain on the same faculty who are simultaneously teaching BPT, MPT, etc in allied institutions. A great academic strain on medical college teachers ,exists,which has never been accounted by MCI nor by Dr Ananthakrishnan.So, on the whole, it means that a great qualified medical teacher shortage exists in India. Either it is due to the excessive number of courses imposed on the same faculty or maybe it is inefficient use of existing qualified medical teachers for non teaching purposes.

Contrary to the opinion of Health ministry, eminent educationists Sood & Adkoli point out that the doctor: population ratio has already exceeded that required by the country and there is mal-distribution of their services. They feel that the menace posed by the growing merchandisation of medical education has to be warded off and efforts should be made to ensure maintenance of standards and check the unplanned growth of substandard medical colleges and substandard education norms in universities or their constituent medical colleges. This mal-distribution of medical manpower is the centered on biased political will and seat purchasing power in the community. With the correction of medical manpower maldisditribution medical standards will harmonize throughout India.[11,12]

Indeed, given the sharp increase in the number of medical colleges and the doubling of enrolment capacity after1980s it is difficult to imagine that enough trained full-time faculty exist to adequately staff the newly created colleges or DNB Hospitals and maintain reasonable teacher-student ratios.[9] Dr Ananthakrishnan proposes to allow MSc from Non Medical Universities to teach Medicine. [7] It will be gross medical impropriety to allow such injustice to be allowed by Medical council of India which is supposed to uphold medical education standards across India. What glory does it give Indian medical education system to have a bunch of unqualified non medical doctor MSc teacher's seeking to run coaching medical classes a la science tuition centers we fail to see. What is the necessity to

increase number of medical college, or medical college seats, in inadequacy of appropriate medical teachers? Is it possible to permit inadequately trained staff to run these colleges, and will the output reflect quality abroad? Emphasis here is not on excellent university results, these MSc teachers, produce by mere mugging up of unconnected facts or figures or excellent power point teaching but what MBBS educated teachers can produce by moulding young doctor student minds by bringing in relevant clinical experience.

**Some Solutions**

Today, India has the highest number of medical colleges in the world and consequently the highest number of medical teachers. Yet, shortage of medical faculty and lack of medically oriented teaching by appropriately trained MD faculty have tarnished Indian medical glory. The unprecedented institutional growth has created a national quality challenge for medical education and has resulted in varying standards across medical graduates. There is a national need for well-trained faculty who will help improve programs to produce quality graduates. [5,14] Annual student intake is said to be a critical factor in assessing the requirement for teachers as per Ananthakrishnan,[7] and should dictate the employment. A punitive MCI, DNB Board and vigilant state medical councils can act synergistically to decrease medical student intake in Medical Institutions where teachers are not ready to go or do not exist. MCI and DNB Board also need to do more for its medical teacher's- give them more respect, recognition, arrange for their pensions, gratuity, relieving orders or get involved in pay scale recommendations as no entity exists till date to safeguard medical teacher interests. Measures are required to ensure private medical college's proper regulation by the medical council. Further, Indian Health ministry has been known to interfere in the functioning of MCI, DCI and DNB Boards, override MCI, DCI and supreme courts decisions and this is undesirable.[12,14,15]

Increasing the retirement age of MD teacher's up to 70 years will harness hard earned medical experience of senior professors to guide preparation of efficient faculty and will reemploy retired teachers . This will also lead to discipline enforcement, more projects, PhDs and papers of relevance. Else, MCI can think of sharing of medical faculty among medical colleges, or dental colleges, and ensure less burdened teaching schedules. Implementing integrated medical education system-will help, as has been experimented in -KMC Manipal, Sri Ramachandra Medical College. Present paramedical system is a confused network of PhDs who have not enriched Medical education system, a proof of which can be the absence of a single Nobel laureate or international repute medical scientist or of the glory of IISc departments, in 270 odd medical colleges across India, even Manipal, or AIIMS in spite of having the system for 50 years. Merging of homogenous specialities like merging of biochemistry with physiology or pathology, microbiology with pathology, or creation of a discipline of laboratory medicine merging pathology, microbiology and biochemistry has been suggested in yahoo groups like mdbiochemists. Merging of homogenous specialities decreases the requirement of professors in biochemistry and microbiology by providing MCI norm requirements of professors from pathology. Also merging of Anatomy with Surgery will be worthwhile and achieve similar objective of providing deficient staff from Surgery department, who happen to be plenty. It is said to bring about some integrated medical education also. This cure is supposed to provide a broad based intermingling for net objective of efficient medical teaching by qualified professors, peers in interrelated departments. We would further extend their argument in suggesting that the proposed speciality merger need not be complete and final but a temporary arrangement for next 20 years.

Acute shortage of medical teachers needs to be filled. Appropriate solution exists within medical education system itself and help can come from recruitment of medical brethren from clinical sciences to fulfill non clinical department norms, as has been happening successfully ,silently ,without MCI approval ,in Tamilnadu and Andhra pradesh government medical colleges. A whole lot of MD or MS or DNB doctors are ready to serve as Medical teachers, but colleges have never used their teachership as MCI does not permit this. Many such part-time consultants who are practicing in community could deliver excellent teaching assignments and help tide over the so called artificial medical teaching crisis.MCI's generosity to allow MDs of homogenous specialties to teach in Pre or Para clinical sciences for a honoraria, rewards system will effectively ,in a short time solve inadequate improper medical staffing problems forever. Number of seats available in various post-graduate medical courses is approximately 11,005 annually which is one third of MBBS graduates coming out every year. Nearly a third of these seats are diplomas and a diplomate cannot be considered for even a junior lecturer post like an MSc graduate, but will be considered for post of Tutor, the lowest cadre of medical teachership. Thus all DCP (Diploma in Clinical Pathology) and DFM (Diploma in Forensic Medicine) loose out Lecturership to their MD colleagues. Increasing the number of MD seats in Para clinical and preclinical sciences and replacing existing Diploma seats with corresponding MD seats is a just approach and should be the right approach for MCI to follow, since in contrast to before 1960s,in present days no postgraduate seat goes vacant-it means there are no shortage of MD aspirants as wrongly assumed by Dr Ananthakrishnan[7] .MCI also has to think of giving Junior lecturership posts to MBBS graduates who have been serving as tutors for more than 3 years in any department .

**Continuing medical education**

Thus there is a strong case for a review of the entire system of medical education and examinations in India. The American style of giving credits for demonstrable good performance throughout the years can be introduced. It will, of course, be

necessary to ensure objective evidence of such assessment and performance.[1,8] The Indian Health ministry has realized that efficient medically qualified teachers are in the best position to mould young physician minds hence, Indian National Knowledge Commission (NKC-2008) proposes raising average standards and creating centers of medical excellence, revised medical accreditation; methods of attracting and retaining talented medical faculty members and devising measures to ignite, promote and sustain the research tradition in medical colleges and teaching hospitals.

Medical teacher incentivisation[8], i.e increments, promotions, paid study leaves will also attract good teachers to stable institutions. In order to recruit good and gifted medical teachers, it is necessary to provide them with regular attractive salaries, amenities and retirement benefits which are realistic and at least on par with the earnings of those in practice.[2] Emigration of high quality physicians who could potentially serve as medical teachers in local Medical colleges may lead to further declines in the quality of medical graduates produced. To address regional inequities for medical training and related availability of doctors, firstly, it may be useful to set up adequately staffed medical research and training institutions in economically backward areas. Secondly, the government could subsidize the medical education of individuals living in backward areas, perhaps by combining such a subsidy with a bond to serve in the backward areas for a limited number of years. Implementing this bond system will be in the control of the health ministry.

For existing medical teachers, high standards of teaching are to be maintained and improved upon with constant seminars and workshops. Teaching aids, computers, medical CDs, DVDs, medical e-books, Internet facilities and availability of the latest journals and literature on the subject should be provided in every medical college or diploma national board certified hospital.[2]At the post graduate level, it is the duty of the senior teacher to train the young doctor so that he learns to perform according to accepted international standards.[2] As a long- term policy, no new medical colleges must be permitted in prosperous states, unless they demonstrate an MCI compliant infrastructure and facilities better than those in existing institutions. A revitalized Medical Council of India must be the only agency permitted to recognize such colleges and health ministry need not have any role.[1] Since advent of the MCI it has been noted that Indian health ministry can not only ignore a negative rating by Medical Council of India, but also openly defy the Supreme Court.[12]

India needs also a MCI controlled and Supreme Court monitored screening system of students admitted to medical colleges under the "discretionary management quota" so that merit remains the paramount criterion. This requires common entrance examinations to assess student performance across colleges, publicly accessible information on admission standards practiced by colleges, including transparent nondiscriminatory ranking by performance, and enforcement of sanctions on colleges violating norms. A useful first step is the government policy of maintaining a accessible list of recognized colleges, but obviously much more needs to be done to implement ways to increase the supply of MD teaching personnel .Indian policy makers need to think proactively about developing a cadre of doctors focused more on medical education and research. Lastly, the Indian Medical Association, Association of Medical Biochemists of India, All India MD/MS Doctors Association, and other national medical and dental professional bodies must play a greater role to foster true medical and dental education and prevent governmental and political interference.[1,12,14]

**COMPETING INTERESTS**
None Declared

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Special Series

# From behind the couch - 'Manipulation'

**Chess Denman**

"Pamela was assessed by the crisis team at home late at night. She had been discharged from the inpatient unit only two days previously. Pamela was threatening to set fire to herself and was wandering around her flat in her bedclothes aroused and waving a lighter. She said her bed was soaked with meths. Pamela said she had debts and there were dealers to whom she owed money who were coming round to get her. She said she did not feel safe in her flat. The crisis team were pretty sure that Pamela had been drinking and taking amphetamines and felt that she was a serious risk to herself and others. Fortunately she agreed to be admitted. By the time she arrived on the ward she was calmer and she seemed to settle quickly. A couple of days later Pamela wanted leave to go to her flat and look after her dogs. She was given 4 hours leave but did not return on time. When she returned late she seemed intoxicated. Staff felt she was abusing the ward and asked for a review with a view to discharge. When Pamela saw the doctor she said she was suicidal and was planning on taking her own life but she denied having drunk alcohol. Pamela was not willing to stay on the ward and so had to be detained she was placed on continuous observations but then managed to cut her self using a concealed razor blade while in the lavatory. Staff negotiated an agreement that Pamela would talk to them if she felt distressed and asked her to hand in any further blades. That evening Pamela had a long conversation with a junior nurse and, after some persuasion handed in some razor blades. She went back to her room and ten minutes later, again despite being on continuous observations managed to cut herself again very severely with a razor blade. The following day in the hand over Pamela was characterised as "manipulative and deceitful". The ward was very full and Pamela was "using up a bed".

Staff often feel as though they are being manipulated by patients or describe their behaviour as "manipulative" and yet this term probably adds little to the management of patients other than the expression of dislike because a wide variety of disapproved of behaviours tends to be grouped under this term. An insight into its meaning and use can be gained by noting that patients with psychosis or melancholic depression do not often attract the appellation. Instead people who are drug and alcohol dependent, people with personality disorders and some depressed patients with atypical symptoms. The key is a sense on the part of the staff that the individual has some voluntary control over their behaviour and that they could change it if they so desired. Another feature is the sense that something is being extracted or demanded in an underhand way. Another feature of situations in which patients are described as manipulative is one where resources are scarce and, for reasons of rationing staff are under pressure not to accede to requests that have resource implications.

In thinking about situations in which staff are tempted to use the idea of manipulation it is probably a good idea to distinguish three potential situations from each other.

In some situations some patients are genuinely manipulative in their intentions. That is to say they are willing to tell untruths or to create situations that persuade or force other people to do things they want without having to ask for them directly. Often patients do this when they judge that were they to ask directly they would not get what they were asking for. If Pamela had asked directly for admission to hospital to avoid her creditors and the drug dealers who were chasing her there is little doubt that this would have been refused. So some part of her aroused behaviour may have been part of a conscious plan to obtain admission to the ward where she would feel safer.

In other situations patients appear manipulative because their actions seem inconsistent or disingenuous but no covert intention exists. So, for example when Pamela says she is going home to look after her dogs that may well have been her real intent. The fact that she then got drunk and returned late is not certain to have been a conscious part of her planning when she asked to leave the ward.

A third group of situations are those in which staff feel that they have been "used" or treated in an unfair way. This is very likely to have been the case in relation to Pamela's cutting behaviour. She is sneaky,conceals blades and evades the nurse who observes her and later she reassures another nurse after receiving a good dollop of care but then immediately cuts herself again. Patients who evade ward observations make nurses understandably angry because they place the nurse at risk of censure and because they are difficult to look after. While this behaviour is annoying and while it may result in increased or prolonged periods of nursing observation it is unlikely to be manipulative. When questioned patients talk about concealing their self harm far more than they reveal it. Thus the aim of the behaviour is to evade control rather than to have an effect on staff.

A final situation in which patients can be labelled manipulative is when they are perceived to be using resources to which they have less claim than others or when they are thought not to be "taking responsibility for their behaviour". Such is the final accusation against Pamela. At such times what they do is labelled as "behavioural" or the decision made about them is that there is no evidence of genuine mental illness.

There are several serious difficulties with this way of thinking about this sort of patient. Such patients are generally thought by the public and the government to be suffering from a mental illness and characterise themselves in this way. They are clearly suffering and also clearly making a hash of their lives. Another problem with this line of thought is that it marks the end point of questioning enquiry about what is going on and often also the end point in relation to creative problem solving designed to improve the situation. Staff and the system turn from therapy to exclusion or expulsion as their main objective. Neither of these objectives turn out to be effective for psychiatric services since patients in this group return despite their ejection and, because of a failure of creative thought their problems remain in status quo.

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None Declared

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**NEXT ISSUE.**

**So what should I do then? - Managing manipulative patients.**

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Students Section

# Neurology – A reflective perspective

**Mathavi Uthayanan and Mashud Souroyer**

For generations the mind has been mystifying physicians all around the world. It is the powerhouse behind everything we do, and everything that we are – therefore there is no wonder that reams of time, research, money and effort has been poured into this1.

The Association of British Neurologist, through various publications in the last 10years, has stated that there are too few neurologist consultants, and that provisions need to be made to ensure that there is comprehensive care to patients in hospitals2. In light of this there has been a recent drive into increasing the number of clinical consultant posts in local hospitals. This drive has lead to more innovative measures being implemented in this field, including new research on pharmaceuticals as well as introduction of new technologies.

A general misconception of the field of Neurology by medical students is that it is too complicated3. However, I found my experience to be one of the most organised, patient orientated, enjoyable experiences I have encountered on a ward setting. The teaching sessions that accompanied the firm brought all of the previous years of knowledge together like a solved jigsaw puzzle – linking the neuroanatomy with the pathophysiology of an illness and the role and impact pharmaceuticals have4. With everything falling into place and having a better understanding, it gave me more confidence to explore further into this field.

Having previously only had brief exposure to Neurology, to be in a committed arena focused on this speciality was a daunting experience. Opposed to other specialities, where history taking is the millstone to your diagnosis, management and follow-up care, there is a much bigger onus on clinical skills and interpreting findings. The obvious signs of loss of sensory or motor functions are evident, but more subtle focal lesions are sometimes harder to pick up, this is when drawing on your clinical knowledge and application is required. This remains one of the evident advantages to Neurology, compared to other disciplines - that it remains clinically orientated. There is only so much that could be galvanised from a case history. As medical students we had ample exposure to the ward, and were able to approach patients and hone in on our clinical skills. As our basic knowledge had been laid down, through teaching session's and also clinical case studies, we had the theory behind many of the clinical assessments, but lacked confidence and appropriate patients to assess. This changed as we integrated ourselves with the close-knit multidisciplinary team and the patients. There seemed to be buoyancy in mood, as we became more proficient undertaking assessments, for instance a cranial nerve examination that once took 10minutes to carry out was halved, without feeling like we had missed anything vital out.

More so, it was an eye-opener to experience, (even for a brief period), the sub-specialities that Neurology caters for, an aspect that I particular enjoyed was neuropsychiatry. Essentially the brain is an intricate piece of machinery, as with all things in life, sometimes this goes awry. For me to observe from a clinician's point of view and come to the same conclusion as my peers, gave me a sense of pride, knowing that I was moving in the right direction in my medical career, and that all that pent up knowledge was at last being implemented on a practical level. Unlike other fields, for the most part we were left to our own devices – we were not spoon fed. This was refreshing, although a little overwhelming at first. We were responsible to find, clerk, assess and present patients to our team-members. The feedback we received was invaluable; it illustrated the extent of our competency and also left you with a sense of achievement knowing that you are capable and apt.

For those that are looking for a speciality once they have started their medical career, Neurology is an exciting and innovative place to be at right now. With an aging population worldwide, more effort, resources and money is being spent on degenerative illnesses such as Alzheimer's disease and Parkinson's disease.5

Although to some extent current treatments offer benefits to sufferers, there is hope that new pioneering forms of treatment will be developed to manage patients. Additionally this gives students and qualified peers alike a great opportunity to conduct research and audits and get the opportunity to be published. Neurology still remains a minefield of the 'unknown', and it seems to be constantly on a quest to better itself and find new measures and treatments to bring to the patients.

With its new advancements in the pipeline, Neurology seems to have a bright future. However, there is the obvious downside to being in a speciality of this nature. You will come into contact with a large number of patients with untreatable disorders. It

needs someone with a strong constitution to see someone that has a poor prognosis and an almost certain decrease in quality of life. For some, there will be an obvious deterioration before your eyes, other's may have already suffered severe neurological deficits that ethical questions on the continuation of the life may arise. These are tough decisions to make, and needs someone with conviction and strong-will to stand by their decision.

Overall Neurology is what you make it, as is every profession. What stands out with Neurology is the exposure you get to patients. For students this is a valuable and undoubtedly crucial time in their medical training to perfect skills that will be called on in the future. Where else would we find another welcoming and encouraging place to learn the tools of our future trade, that allows freedom to learn, exposure to patients, a myriad of different diagnosis, and most importantly a practical use of your knowledge and clinical skills?

**COMPETING INTERESTS**
None Declared

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Medicine in Pictures

# Pictorial essay: endotracheal tube and nasogastric tube on chest radiographs

**Krishnan Melarkode and M Y Latoo**

Chest radiographs are one of the most common radiological procedures performed in medical practice. The chest radiograph should ideally include views of the heart, lungs, trachea, mediastinum, bones of the chest and upper part of the abdomen. Chest radiographs are normally taken in the posterior-anterior (PA) view with the patient in upright / standing position but for patients admitted in the intensive care unit (ICU) or other emergency situations, this is not possible and so they are taken in the supine (anterior-posterior views) or semi-erect position.

Chest radiographs are done not only for diagnostic reasons to look for abnormalities in the lungs, soft tissues and bones but also to check the position of various invasive lines and tubes. In this article, we aim to discuss and compare the normal and abnormal positions of both the endotracheal tube (ETT) and nasogastric tube (NG) on chest radiographs.

**Endotracheal tube (ETT):**

Endotracheal tubes are used to secure the patient's airway. Modern ETT's have a radio-opaque line running along their length which enables us to determine their position on chest radiographs [1].

Clinical methods [2] that can be used to determine the appropriate position of the ETT include:

- Symmetrical rise and fall of the chest wall with each breath (on inspection and palpation of the chest).
- Auscultation of the lung fields
- Use of capnography

However, clinical methods cannot confirm how high or low the ETT is situated in the trachea. This can be confirmed by chest radiography. Optimum position of the ETT is required to ensure ventilation of both lungs.

A correctly positioned ETT lies in the mid trachea and its tip is approximately 5-7 cm above the carina [3] as seen in **Fig: 1** (CR-1827).

In **Fig: 2** (CR-1820), the tip of the ETT is low lying and is at the origin of the right main bronchus. Further migration of the ETT will result in right sided endobronchial intubation and collapse of the left lung. This will result in decreased oxygen saturation values ($SpO_2$) on a pulse oximeter and low arterial partial pressure of oxygen ($PaO_2$) on analysis of an arterial blood gas specimen.

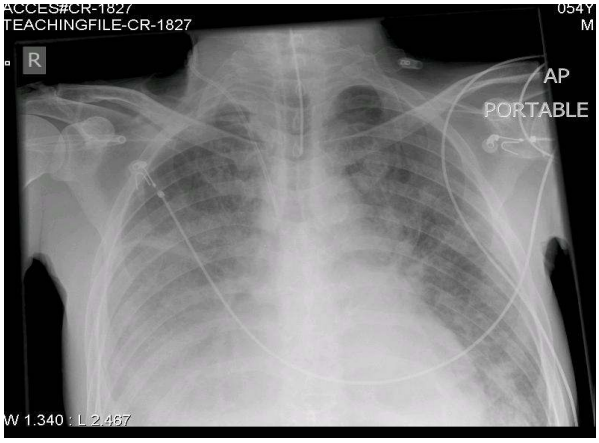


**Figure 1**

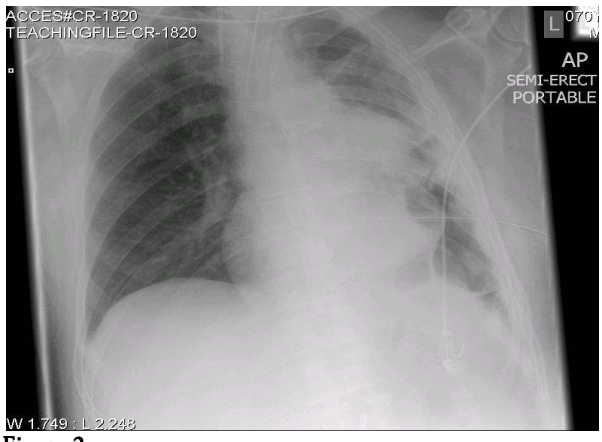


**Figure 2**

**Nasogastric tube (NG):**

Nasogastric tube (NG) or orogastric tube (OG) is inserted for providing enteral nutrition, administration of drugs or for gastric drainage. NG feeding is a common practice in all age groups. There is a risk that the NG feeding tube can be misplaced into the lungs during insertion or may move out of the stomach at a later stage.

In the past, various methods [4] have been used to determine the position of NG feeding tubes.

These included:

- Auscultation of air insufflated through the feeding tube - 'whoosh' test
- Testing acidity/alkalinity of the aspirate using blue litmus paper
- Interpreting absence of respiratory distress as an indicator of correct positioning
- Monitoring bubbling at the end of the NG tube
- Observing the appearance of the feeding tube aspirate

The National Patient Safety Agency (NPSA) have issued a patient safety alert and have recommended that the above methods are not reliable and therefore should not be used to detect the position of NG tubes.

The NPSA recommend [5]:

- Measuring the pH of the aspirate using pH indicator strips/paper
- Use of radiography

The most accurate method for confirming the correct position of a NG feeding tube is radiography [5].

The pH of the gastric aspirate can be affected by ongoing enteral feeding and medications *viz*: antacids, $H_2$ antagonists and proton pump inhibitors. In these cases, measuring the pH of the aspirate may not be useful and so use of radiography is recommended. The NPSA have issued guidance on how to confirm the position of nasogastric feeding tubes.

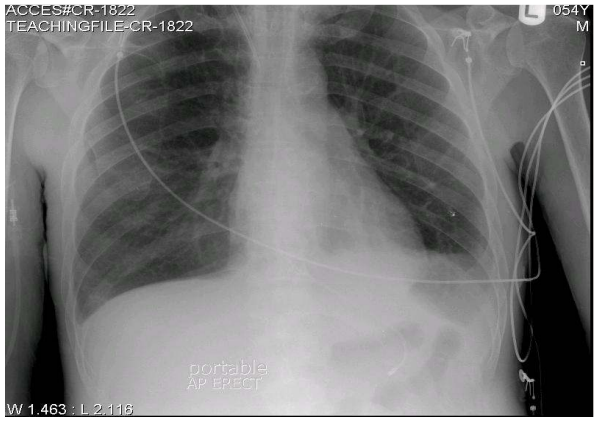


**Figure 3**

**Fig: 3** (CR-1822) indicates the normal position of the NG tip below the diaphragm in the upper part of the stomach (fundus).

**Fig: 4** (CR-1826) shows the abnormal position of the NG tube situated in the right lower lobe bronchus. If NG feeds are commenced, this will result in lung injury.

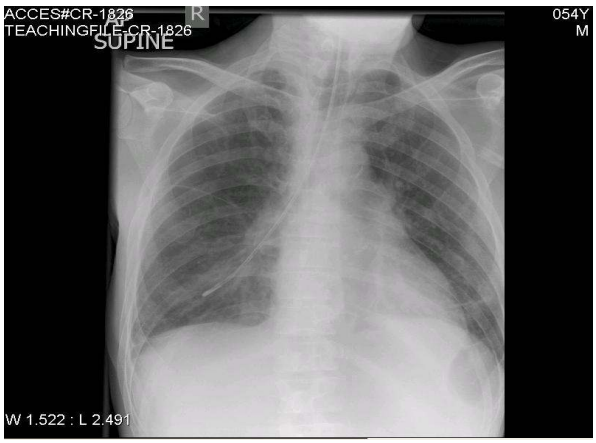


**Figure 4**

## Conclusion

We have highlighted the optimum position of both the ETT and NG tube on chest radiographs. Optimum positioning is required not only for safety reasons to avoid complications but also for optimum monitoring and treatment of patients. This series of chest radiographs will benefit not only medical students and doctors from all specialties but also nurses, physiotherapists and paramedical teams who will be involved in the care of critically ill patients.

## Self Assessment

MCQ 1:

On a chest radiograph, the tip of the ETT:

a. should lie very close to carina

b. should lie 5-7 cm above the carina

c. should lie 5-7 mm above the carina

d. The ETT cannot be visualised on a chest radiograph

MCQ 2:

Which one of the following tests is the most accurate method to determine the correct position of NG feeding tubes?

a. testing the aspirate from the NG tube using a blue litmus paper

b. whoosh test

c. measuring the pH using pH indicator strips/paper

d. radiography

**Answers for MCQ's:**

MCQ 1: b

MCQ 2: d

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**COMPETING INTERESTS**
None Declared

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Miscellaneous

# Upcoming Medical Meetings/Conferences

**CAMBRIDGE CONFERENCE ON BREAST CANCER IMAGING**
March 23-24, 2009
Contact: Hampton Medical Conferences, Secretariat Tel: 011-44-20-8979-8300 Fax: 011-44-20-8979-6700 Email: hmc@hamptonmedical.com Website: www.cambridgeconferencebci.ukevents.org
Radiology/Imaging,
United Kingdom / Cambridge

**2009 ANNUAL MEETING OF THE BRITISH SOCIETY OF GASTROENTEROLOGY** March 23-26, 2009
Contact: British Society of Gastroenterology Tel: 011-44-207-387-3534 Fax: 011-44-207-487-3734 Email: bsg@mailbox.ulcc.ac.uk Website: www.bsg.org.uk/meet_calendar/calendar.htm
Gastroenterology
United Kingdom / Glasgow

**BASIC PRACTICAL SKILLS IN OBSTETRICS & GYNAECOLOGY**
March 23-25, 2009
Contact: Conference Office, Royal College of Obstetricians and Gynaecologists Tel: 011-44-20-7772-6245 Fax: 011-44-20-7772-6388 Email: conference@rcog.org.uk Website: www.rcog.org.uk/meetings
Obstetrics/Gynecology
United Kingdom / London

**OESOPHAGO-GASTRIC CANCER SURGERY**
March 23-25, 2009
Contact: Royal College of Surgeons of England Tel: 011-44-20-7869-6328 Email: general@rcseg.ac.uk Website: www.rcseng.ac.uk
Oncology / Surgery
United Kingdom / London

**SPECIALTY SKILLS IN BREAST DISEASE MANAGEMENT (ADVANCED)**
March 23-26, 2009
Contact: Royal College of Surgeons of England Tel: 011-44-20-7869-6340 Email: breast@rcseng.ac.uk Website: www.rcseng.ac.uk
Plastic Surgery / Surgery
United Kingdom / London

**CHILD HEALTH PROMOTION & SURVEILLANCE**
March 23-25, 2009
Contact: Symposium Office, Imperial College of London Tel: 011-44-20-7594-2150 Fax: 011-44-20-7594-2155 Email: sympreg@imperial.ac.uk Website: www.prossl.com/symposiassl/events.asp
Pediatrics
United Kingdom / London

**2009 EUROPEAN ASSOCIATION FOR THE STUDY OF DIABETES (EASD) ROBERT TURNER CLINICAL RESEARCH COURSE**
March 23-27, 2009
Contact: EASD Secretariat Tel: 011-49-211-758-4690 Fax: 011-49-211-758-46929 Email: secretariat@easd.org Website: www.easd.org
Endocrinology
United Kingdom / Oxford

**ROYAL COLLEGE OF PHYSICIANS - RESPIRATORY FAILURE**
March 24, 2009
Contact: Royal College of Physicians Tel: 011-44-20-7935-1174 Email: conferences@rcplondon.ac.uk Website: www.rcplondon.ac.uk/event
Respirology, United Kingdom / London

**5TH ANNUAL BRITISH COSMETIC DERMATOLOGY GROUP COURSE**
March 26-27, 2009
Contact: Rebecca Bennett Email: Rebecca_L_Bennett@btopenworld.com Website: www.bad.org.uk
Dermatology
United Kingdom / London

**IDENTIFYING T CELL SUBSET PHENOTYPE AND FUNCTION IN PARASITE INFECTIONS.**
March 27, 2009
Contact: EuroSciCon Email: enquiries@euroscicon.com Website: www.euroscicon.com
Infectious Disease / Other Specialties
United Kingdom / Welwyn Garden City United Kingdom / London

**ANNUAL SCIENTIFIC MEETING OF BRITISH SOCIETY FOR INVESTIGATIVE DERMATOLOGY (BSID**
March 30-April 01, 2009
Contact: Dr. Graham Ogg, BSID Chairman Tel: 011-44-1865-222-334 Fax: 011-44-1865-222-502 Email: graham.ogg@ndm.ox.ac.uk Website: www.bsid.org.uk
Dermatology
United Kingdom / Cirencester

**164TH MEETING OF THE SOCIETY FOR GENERAL MICROBIOLOGY**
March 30-April 03, 2009
Contact: Josiane Dunn, Meetings Administrator Tel: 011-44-118-988-1805 Fax: 011-44-118-988-5656 Email: meetings@sgm.ac.uk Website: www.sgm.ac.uk/meetings
Hematology / Infectious Disease / Other Specialties
United Kingdom / Harrogate

**2009 ANNUAL MEETING OF THE BRITISH PAIN SOCIETY**
March 31-April 03, 2009 .
Contact: The British Pain Society Tel: 011-44-207-269-7840 Fax: 011-44-207-831-0859 Email: info@britishpainsociety.org Website: www.britishpainsociety.org
Pain Management
United Kingdom / London

**9TH LONDON INTERNATIONAL EATING DISORDERS CONFERENCE**
March 31-April 02, 2009
Contact: MA Healthcare Events Tel: 011-44-20-7501-6762 Fax: 011-44-20-7733-8174 Website: www.mahealthcareevents.co.uk
Family Medicine / General Medicine / Pediatrics / Psychiatry
United Kingdom / London

**ROYAL COLLEGE OF PHYSICIANS - ACUTE MEDICINE**
April 01, 2009
Contact: Royal College of Physicians Tel: 011-44-20-7935-1174 Email: conferences@rcplondon.ac.uk Website: www.rcplondon.ac.uk/event
General Medicine / Internal Medicine
United Kingdom / London

**UROLOGICAL ANATOMY FOR SURGERY**
April 03, 2009
Contact: Royal College of Surgeons of England Tel: 011-44-20-7869-6340
Email: urology@rcseng.ac.uk Website: www.rcseng.ac.uk
Surgery / Urology
United Kingdom / London

**UK RADIATION ONCOLOGY CONFERENCE (UKRO)**
April 06-08, 2009
Contact: UKRO Secretariat Tel: 011-44-1904-610-821 Fax: 011-44-1904-612-279 Email: ukro@ipem.ac.ukWebsite: www.ukro.org.uk
Oncology / Radiology/Imaging
United Kingdom / Cardiff

**OTOLARYNGOLOGY FOR GENERAL PRACTITIONERS**
April 07, 2009
Contact: Royal College of Surgeons of England Tel: 011-44-20-7869-6336
Email: ent@rcseng.ac.uk Website: www.rcsengac.uk
General Medicine
United Kingdom / London

**EUROPEAN PSYCHIATRIC ASSOCIATION SECTION OF NEUROIMAGING 5TH ANNUAL MEETING: GENES, BRAIN, BEHAVIOUR**
April 09-10, 2009
Contact: Institute of Psychiatry, King's College London Tel: 011-44-20-7836-5454 Email: epaneuroimaging2009@iop.kcl.ac.uk Website: www.iop.kcl.ac.uk
Psychiatry
United Kingdom / Edinburgh

**BASIC PRACTICAL SKILLS IN OBSTETRICS & GYNAECOLOGY**
April 15-17, 2009
Contact: Conference Office, Royal College of Obstetricians and Gynaecologists
Tel: 011-44-20-7772-6245 Fax: 011-44-20-7772-6388
Email: conference@rcog.org.uk Website: www.rcog.org.uk/meetings
Obstetrics/Gynecology
United Kingdom / London

**PROMPT (PRACTICAL OBSTETRICS MULTI-PROFESSIONAL TRAINING) COURSE: TRAINING THE TRAINERS**
April 16, 2009
Contact: Conference Office, Royal College of Obstetricians and Gynaecologists
Tel: 011-44-20-7772-6245 Fax: 011-44-20-7772-6388
Email: conference@rcog.org.uk Website: www.rcog.org.uk/meetings
Obstetrics/Gynecology
United Kingdom / London

**DRAWING FOR SURGEONS**
April 16-17, 2009
Contact: Royal College of Surgeons of England Tel: 011-44-20-7869-6337
Email: drawingforsurgeons@rcseng.ac.uk Website: www.rcseng.ac.uk
Surgery
United Kingdom / London

**PROMPT (PRACTICAL OBSTETRICS MULTI-PROFESSIONAL TRAINING) COURSE: TRAINING THE TRAINERS**
April 17, 2009
Contact: Conference Office, Royal College of Obstetricians and Gynaecologists
Tel: 011-44-20-7772-6245 Fax: 011-44-20-7772-6388
Email: conference@rcog.org.uk Website: www.rcog.org.uk/meetings
Obstetrics/Gynecology
United Kingdom / London

**2009 ANNUAL MEETING OF THE RENAL ASSOCIATION**
April 20-24, 2009
Contact: The British Pain Society Tel: 011-44-207-269-7840 Fax: 011-44-207-831-0859 Email: info@britishpainsociety.org
Website: www.britishpainsociety.org
Nephrology
United Kingdom / Liverpool

**3RD NATIONAL CONFERENCE: TREATING SCHIZOPHRENIA**
April 27-28, 2009 Contact: MA Healthcare Events Tel: 011-44-20-7501-6762
Fax: 011-44-20-7733-8174 Website: www.mahealthcareevents.co.uk
Psychiatry
United Kingdom / London

**RHEUMATOLOGY 2009**
April 28-May 01, 2009
Contact: Louis Bellintani, Education and Events Officer Tel: 011-44-20-7842-0913 Fax: 011-44-20-7842-0914 Email: conferences@rheumatology.org.uk
Website: www.bsrconference.org.uk Rheumatology United Kingdom / Glasgow

**OPERATIVE SKILLS IN NEUROSURGERY**
April 28-30, 2009
Contact: Royal College of Surgeons of England Tel: 011-44-20-7869-6336
Email: neurosurgery@rcseng.ac.uk Website: www.rcseng.ac.uk
Neurology / Surgery
United Kingdom / London

**2009 PATIENT SAFETY CONGRESS**
April 30-May 01, 2009
Contact: Customer Service Team Tel: 011-44-207-554-5800
Email: psc2009@emap.com Website: www.patientsafetycongress.co.uk
Other Specialties
United Kingdom / Birmingham

**ROYAL COLLEGE OF PHYSICIANS - DEVICE THERAPY FOR HEART FAILURE**
April 30, 2009
Contact: Royal College of Physicians Tel: 011-44-20-7935-1174
Email: conferences@rcplondon.ac.uk Website: www.rcplondon.ac.uk/event
Cardiology
United Kingdom / London

**RISK MANAGEMENT AND MEDICO-LEGAL ISSUES IN WOMEN'S HEALTH**
May 06-07, 2009
Contact: Conference Office, Royal College of Obstetricians and Gynaecologists
Tel: 011-44-20-7772-6245 Fax: 011-44-20-7772-6388
Email: conference@rcog.org.uk Website: www.rcog.org.uk/meetings
Legal/Ethics / Obstetrics/Gynecology
United Kingdom / London

**SPECIALTY SKILLS IN ONCOPLASTIC & BREAST RECONSTRUCTION SURGERY (ST 5-7)**
May 06-07, 2009
Contact: Royal College of Surgeons of England Tel: 011-44-20-7869-6332
Email: breast@rcseng.ac.uk Website: www.rcseng.ac.uk
Plastic Surgery / Surgery
United Kingdom / London

**ROYAL COLLEGE OF PHYSICIANS - NEUROLOGY ON ACUTE TAKE**
May 07, 2009
Contact: Royal College of Physicians Tel: 011-44-20-7935-1174
Email: conferences@rcplondon.ac.uk Website: www.rcplondon.ac.uk/event
Neurology
United Kingdom / London

**THEORETICAL ATSM COURSE IN LAPAROSCOPY SURGERY**
May 08, 2009
Contact: Conference Office, Royal College of Obstetricians and Gynaecologists
Tel: 011-44-20-7772-6245 Fax: 011-44-20-7772-6388
Email: conference@rcog.org.uk Website: www.rcog.org.uk/meetings
Obstetrics/Gynecology
United Kingdom / London

**URODYNAMICS ATSM COURSE**
May 11-12, 2009
Contact: Conference Office, Royal College of Obstetricians and Gynaecologists

Tel: 011-44-20-7772-
6245 Fax: 011-44-20-7772-6388 Email: conference@rcog.org.uk
Website: www.rcog.org.uk/meetingsObstetrics/Gynecology / Urology
United Kingdom / London

**EMERGENCY SKILLS IN MAXILLOFACIAL SURGERY**
May 11-12, 2009
Contact: Royal College of Surgeons of England Tel: 011-44-20-7869-6340
Email: maxfac@rcseng.ac.uk Website: www.rcseng.ac.uk
Emergency Medicine / Surgery
United Kingdom / London

**OPERATIVE SKILLS IN EAR, NOSE & THROAT SURGERY**
May 13-14, 2009
Contact: Royal College of Surgeons of England Tel: 011-44-20-7869-6336
Email: ent@rcseng.ac.uk Website: www.rcseng.ac.uk Otolaryngology / Surgery
United Kingdom / London

**GP REFRESHER COURSE**
May 13-15, 2009
Contact: Symposium Office, Imperial College London Tel: 011-44-20-7594-2150 Fax: 011-44-20-7594-2155 Email: sympreg@imperial.ac.uk
Website: www.prossl.com/symposiassl/events.asp
Family Medicine / General Medicine
United Kingdom / London

**BIOLOGICAL & PHARMACOLOGICAL ASPECTS OF PERINATAL PSYCHIATRY**
May 14, 2009
Contact: Institute of Psychiatry, King's College London Tel: 011-44-20-7836-5454 Email: available through website Website: www.iop.kcl.ac.uk
Psychiatry
United Kingdom / London

**ROYAL COLLEGE OF PHYSICIANS - ACUTE AND GENERAL MEDICINE FOR THE PHYSICIAN**
May 20-21, 2009
Contact: Royal College of Physicians Tel: 011-44-20-7935-1174
Email: conferences@rcplondon.ac.uk Website: www.rcplondon.ac.uk/event
General Medicine
United Kingdom / Birmingham

**OBSTETRIC ANAESTHESIA 2009**
May 20-22, 2009 .
Contact: Meeting Secretariat Tel: 011-44-2-087-411-311 Fax: 011-44-2-087-410-611 Website: www.oaa-anaes.ac.uk
Anesthesiology / Obstetrics/Gynecology
United Kingdom / Jersey

**FORENSIC GYNAECOLOGY**
May 21-22, 2009
Contact: Conference Office, Royal College of Obstetricians and Gynaecologists
Tel: 011-44-20-7772-6245 Fax: 011-44-20-7772-6388
Email: conference@rcog.org.uk Website: www.rcog.org.uk/meetings
Legal/Ethics / Obstetrics/Gynecology
United Kingdom / London

**INFECTIOUS DISEASES: ADULT ISSUES IN THE OUTPATIENT AND INPATIENT SETTING LONDON TO IRELAND CRUISE**
May 24-29, 2009
Contact: MCE Conferences Tel: 888-533-9031 Fax: 858-777-5588
Email: info@mceconferences.com Website: www.mceconferences.com
Family Medicine / Internal Medicine
United Kingdom / London

**BASIC PRACTICAL SKILLS IN OBSTETRICS & GYNAECOLOGY**
May 26-28, 2009
Contact: Conference Office, Royal College of Obstetricians & Gynaecologists
Tel: 011-44-20-7772-6245 Fax: 011-44-20-7772-6388
Email: conference@rcog.org.uk Website: www.rcog.org.uk/meetings
Obstetrics/Gynecology
United Kingdom / London

**ENDOSCOPIC SUTURING TECHNIQUES**
May 27-28, 2009
Contact: Royal College of Surgeons of England Tel: 011-44-20-7869-6337
Email: MIS@rcseng.ac.uk Website: www.rcseng.ac.uk
Surgery
United Kingdom / London

**CURRENT ISSUES IN SEXUAL HEALTH**
May 28-29, 2009
Contact: Mark Allen Group Tel: 011-44-20-7501-6762 Fax: 011-44-20-7733-8174 Email: conferences@markallengroup.co.uk
Website: www.mahealthcareevents.co.uk
Infectious Disease
United Kingdom / London

**PROGRESS IN STEM CELL BIOLOGY**
May 29, 2009 .
Contact: EuroSciCon Email: enquiries@euroscicon.com
Website: www.euroscicon.com
Biochemistry / Hematology
United Kingdom / Welwyn Garden City