

Orthopaedics in an unjust world

Whither Indian orthopaedics?

Research in orthopaedics must have relevance to our common problems and our culture

PK Sethi

Professor B Mukhopadhyaya oration, COE conference, September 1998, Baroda.

I would like to use this opportunity to talk about the values which Prof. Mukhopadhyaya has been trying to instill in us and which, I believe, need to be reiterated if we want to practice our specialty to serve the masses of our vast country with its glaring contrasts between the rich and the poor.

I shall not dwell on the personal qualities of Mukhopadhyaya, the man. I have already done so in other fora, which bear testimony to the wide sweep of his interests, underscoring the point that an orthopaedic surgeon ought not to be a mere technologist and scientist but a man of culture, understanding our complex social order, the traditions and the belief systems of his patients, our economic disparities and scant resources. Only then can he serve his patients well, with wisdom and empathy.

When I scan the orthopaedic scenario in our country today, and the direction along which it is moving, I am increasingly baffled. We have been so bewitched by some of the so-called high technology in the western medical world that we are losing sight of the problems, which really ought to be of concern and which are very different from those encountered in affluent western societies. This is making us increasingly irrelevant to the needs of our masses. We have started catering to the needs of our urban rich who believe that whatever is possible in New York or London should be made available to them. The poor get ignored and marginalised. There is a moral and ethical dimension which we cannot ignore. It requires hard work and an

intense intellectual effort to try to find our own solutions.

Let us look at what some of our great surgeons did in the past. Mukhopadhyaya took upon himself to work on osteoarticular tuberculosis, pyogenic osteomyelitis, septic arthritis of hip of infancy and adolescence, neglected clubfeet and late and neglected closed and open fractures. In each of these fields he made seminal contributions. A very significant but less widely published concern of his has been post-operative infections. He is one of the few honest surgeons who carefully tried to find out, document and analyse his own post-operative infection rates. I consider this effort to be particularly relevant to the increasingly invasive character Indian orthopaedics is taking today, mimicking the West with a total disregard of the working conditions, teamwork and discipline prevalent in our own hospitals and operating rooms.

Look what Paul Brand did for his leprosy patients and for hand surgery in a modest set-up at Vellore, Mangalore, Gopal Kini for foot infections and poliomyelitis, NH Antia for facial disfigurement in leprosy, Mary Verghese and now for traumatic paraplegia in our villagers, a tradition continued by Suranjan Bhattacharji at Vellore. Shailendra Bhattacharji's work on post-traumatic stiff elbows is an outstanding example of original treatment of one of the commonest clinical problems we encounter in our country. This is just a small list of a lot of worthwhile work done by surgeons with sheer hard work, perseverance and innovation while working with scant resources. They have in common an incisive intellect, a sense of commitment and a sensitivity to our own problems. Those who lament the lack of financial resources should

remember that India produced outstanding scientists in our pre-independence era when there was little funding and facilities for research. The names of CV Raman, JC Bose, Meghnad Saha, Satyen Bose and KS Krishnan come to mind. But when Nehru built the chain of national research laboratories to provide every available facility, have we produced any scientists of their calibre? Good work can be done in sheds, garages, and basements if there is a will. Affluence often changes priorities and can be counter-productive.

Our problems

I think it is essential for our work to have relevance to our own common problems, to organise an ongoing study of the prevailing orthopaedic conditions in our community. Our personal impressions, based on hospital practice in an urban setting, provide a very skewed picture. Most of us are either indulging in operative fixations of fractures, internal or external, joint replacement surgery, arthroscopic surgery or Ilizarov methods, for limb lengthening, corrections of deformities and bone transport — or at least dreaming about them. There is no denying that these procedures have provided us vastly improved methods of treatment in properly selected cases in well equipped hospitals in our large metropolitan towns by experienced surgeons. But Bombay, Calcutta, Madras and Delhi do not represent the Indian reality. A rat race has started among us to ape them, with everyone vying to acquire a superstar status. This leaves behind a large residuum of problems which need to be attended to and about which we have stopped thinking. I feel we need to change gears and address ourselves to our common problems and find solutions which can

P. K. Sethi, Vivekananda Marg, Jaipur, 302 001.



be achieved with our extremely limited resources.

For this, we should seek assistance from our epidemiologists, with whom there should be a continuous interaction, as also with our general practitioners and rural doctors. Metropolitan hospitals are full of severe trauma cases and patients requiring elective work find it hard to gain admittance. There is also the very large group, which constitutes our office practice, and their pattern has been continuously changing. There is less tolerance for pain, or acceptance of ageing, than when we encountered earlier. There is also the fascinating subject of the geography of medicine. Knowing that, and why some conditions are more prevalent in certain territories would not only help us understand the relative roles of genetic and environmental factors but also lead us to a more rational planning of our services.

I have an impression that the pattern of ailments bringing patients to us is changing. I do not see the classical acute haematogenous pyogenic osteomyelitis in children with the same frequency as earlier. Whether there is an actual decline or whether these infections are being treated at our peripheral centres and do not reach us is difficult to say. Osteoarticular tuberculosis is no longer seen in its earlier classical forms with multiple sinuses and its actual incidence has shown a decline, though it is resurfacing. One often encounters disease patterns modified by ill-conceived drug treatment. I never saw as many congenital dislocations of the hip as I see now. Congenital limb-deficient children are being seen more frequently. Perthes' disease of hip was encountered earlier but considered insignificant compared to tubercular hips, and we had little to offer by way of treatment. This has become more prominent in our management agenda, as our understanding of its radiological classification, the concept of 'head at risk' and the 'containment principle' have emerged. Yet there are cases which

cannot be neatly docketed in these classifications. This is why I rate the study of the Manipal group deserving of more attention. Other centres need to take this up and add to our understanding of the natural history of this condition on a long-term basis.

Congenital clubfoot remains as complex and enigmatic as ever. An increasing frequency of surgical misadventure results in feet getting permanently ruined. Our training of younger surgeons is clearly deficient and we should be allocating more curriculum time to this most commonly encountered congenital deformity.

Poliomyelitis remains the commonest single cause of physical disability, whatever our populist declarations on polio immunisation may claim. The story of polio vaccination is a national scandal, with 'dud' vaccines often being administered. All of us encounter children developing paralytic polio in spite of having had the stipulated doses of oral vaccine. Orthopaedic surgeons should be documenting such cases to launch a public interest pressure group instead of allowing our politicians and bureaucrats to continuously mislead our public. Lone voices of protest are quickly smothered, as I have personally experienced.

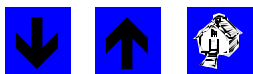
Surgery for poliomyelitis is often so complex and baffling and demands such an intellectual effort that one could make this into a full-time career. Simplistic solutions and camp surgery, which allows no time for meditation and reflection, often do more harm than good. Rational decision making is not possible without a clearer understanding of biomechanics and locomotion, but we are not teaching these subjects to our post-graduates. We can no longer look for guidance to the West, where this problem is no longer encountered. There is also the great need of prevention medicine in minimising contractures and deformities by spending more time with parents educating them about simple means of looking after paralysed limbs. It saddens me that

most of my younger colleagues are just not interested in the problems posed by poliomyelitis.

Cerebral palsy reaches us more of ten for treatment — a result possibly of advances in neonatal paediatrics. More brain-damaged children now survive and offer challenges of a most difficult kind. Ill-conceived operative treatment worsens the disability. Heel cords are lengthened with abandon, leading to a worsening of the crouch, an example of how viewing a deformity in isolation can upset the balance in an affliction which is widespread and whose various components are closely inter-related. This is a perfect example of Severid's law: "All problems are results of solutions." Every time we surgically intervene, we should remind ourselves of Severid's law and ask ourselves: "Shall we be creating new problems for this patient?"

I encounter bilateral idiopathic avascular necrosis of femoral heads far more frequently and am baffled as to its etiology. The known causes — alcoholism, steroids, thalassaemia — are often missing. Many women date the onset following an uncomplicated childbirth. This condition merits a carefully designed multicentre study and its natural history needs to be followed up. Management is especially tricky for this younger age group and the aggressive intervention often indulged in may be unwise.

Probably the most difficult problem I encounter increasingly frequently are intractable infections following operative intervention in closed fractures. Indiscriminate use of antibiotics, metallic implants and the phenomenon of bacterial adherence and the glycocalyx responsible for 'cryptic infections' all make this a vexing problem to treat. The increasing frequency of interventional treatment, now spread out to even peripheral hospitals manned by inexperienced surgeons working in atrocious conditions, is an alarming development. It forces one to concede reluctantly to Ivan Illich's accusation that the modern physician is the most



virulent pathogen let loose on mankind.

Lifestyle and culture

Ours is a floor-sitting culture and this places functional demands on our lower limbs, which the chair-sitting culture of the West does not encounter. For us, the lower limbs are not meant merely for standing and walking. They should also be flexible enough to allow us to lower ourselves to the ground for squatting or sitting cross-legged. Our hips and knees have to be supple and our heel cords have to allow the feet to rest squarely on the floor. This is a matter of practice and our soft tissues, muscles and joint capsules get used to this stretching from our childhood.

These functional demands are not permitted in our hip and knee replacements. While joint replacement can serve our urban affluent classes who have switched over to a western lifestyle, they are ruled out for our traditional masses, not only because of their prohibitive costs but also because they would demand a radical change in their lifestyle. Now here is a special challenge for us. How do we overcome the two contrasting demands of stability and the required range of mobility? Considering that many of our hip problems result from infection (where a joint replacement may flare up dormant infection) and most of these patients are in younger age groups, what solutions can we offer? We have to go back to the past, study what our elder generation of surgeons did, resurrect some of these procedures and improve on them.

It is curious how squatting as a posture has been frowned upon by most of our orthopaedic surgeons. People with backaches and disc problems are admonished to avoid this position and many of us believe that this might predispose them to osteoarthritis of the knee. These views have never been, to my knowledge, subjected to any rigorous studies. It is interesting that many western observers advocate squatting as being good for our backs, and Fahrni of Vancouver, studying cross-cultural incidence of backaches,

actually visited India to look at the backs of tribals in Ratlam region and wrote up a monograph extolling the virtues of squatting. I have personally always advocated squatting for my back cases and I am struck by the suppleness for the spine resulting from this practice.

Gunn, while working at Singapore, tried to explain the relative rarity of primary osteoarthritis of the hips in Orientals to their habit of cross-legged sitting, which, according to him, allows the femoral heads to be fully contained in the acetabulum.

Quite frankly, do we really have concrete evidence that squatting predisposes to osteoarthritis of knees, as many allege? I know of none.

Let us not condemn outright lifestyle practices, which have stood us well in our culture for centuries. What shames me is when outsiders have to come to remind us of these things and show themselves to be more open-minded than us.

To ask our farmers and housewives to abstain from bending or sitting on the floor seems to me to be irrational and disabling. When I see strapping Jat farmers from my neighbouring states consulting me, carrying a metallic lumbar brace, demoralised and defeated, out of work for months or years because they have been warned never to bend, squat or lift, just because they had suffered from lumbago, I have reason to question such prescriptions. In this context, I would strongly recommend a reading of St Clair Strange's presidential address to the Royal Society of Medicine entitled *Debunking the Disc*. I do not know of a more devastating critique of many of our favoured practices for low backache and sciatica. At least let us be aware that there are different ways of thinking amongst some of our most astute clinicians.

Recent trends in Indian orthopaedics

While many of our great teachers took it upon themselves to solve our own

problems, the present trend seems to be to look increasingly westwards. Ali Mazrui describes it as submissive dependence. Prof. Amulya Reddy derisively labelled it as 'blurred Xerox copies' of work done in the West. Also, like physicians who were brainwashed and bribed by multinational drug companies, winning the title of 'pill peddlers' by Donald Gould in his book *The medical Mafia*, we are now becoming victims of modern marketing strategies of the powerful medical industrial lobby. It offends my sensitivity when I find how our professional conferences and workshops are being hijacked, dominated and controlled by commercial enterprises. I do not quite know who is helping whom.

Abuse of antibiotics

The increasing use of newer and expensive antibiotics to treat infections, without appreciating that bacteria possess mechanism to mutate into resistant strains, has led to the emergence of Darwinian medicine which is warning us that our abuse of antibiotics is becoming an ecological threat. Soon our biosphere will have germs against whom our future generations will be rendered helpless. Remember also Pasteur's confession at his deathbed: "Germs are nothing. Terrain is everything.." This seed and soil analogy was taught to me years ago by Mukhopadhaya who believed that a good soft tissue cover provided by a vascular flap, and strategically placed adequate drainage, are an effective treatment for bone infections. This advice has stood me in good stead all these years. I use antibiotics with great restraint.

So-called high technology medicine

The emergence of electronics, digital display systems, microchips and computers is now changing the entire scenario. The extent to which both patients and doctors have become mesmerised by contemporary diagnostic technology is remarkable.



It appears that no doctor is now willing to make a diagnosis and no patient is willing to accept one without recourse to the formidable diagnostic armoury offered by the medical industrial complex. This is leading to amazing distortions. A housewife with a backache now comes to me with a large packet of investigations and tells me she has a 'disc'. When questioned, she pulls out her CT and MRI scans and asks me to see for myself. We have made them forget their language of pain and suffering and started treating images rather than persons. We have stopped being good listeners and have forgotten the art of communication with our patients, an art which plays such an important role in the equation for recovery. This is what Lewis Thomas called the non-technological function of medicine. Words, said Norman Cousins, can be gate openers or gate slammers. They can open the way to recovery or make a patient tremulous, fearful, dependent and resistant. We can draw out a heroic response or by using the wrong words, complicate the healing environment. They are no less central in the care of our patients than the factual knowledge that goes into our treatment.

So disturbing has been this obsession for new imaging techniques that the *New England Journal of Medicine* published a whimsical article entitled 'CAT fever'. These have not only put the cost of medicine out of the reach of the poor, but have also led to unethical practices such as kickbacks and often unnecessary surgery. These gadgets possess a 'symbolic value' with very limited 'use value'.

The use of power tools, advances in metallurgy and polymer sciences, fibre optics and image intensifiers has started transforming the scenario inside our operating rooms. The visual impact of these marvels of technological gadgetries literally sweeps us off our feet. The powerful medical industrial enterprise is using all tricks of modern advertising to push us into buying instrumentation, which are obscenely

expensive and become out of date in no time. We are, conceptually, losing our identity and becoming a mere cog in the wheel, as it were, in this mad rush for megatechnology.

The advances often cited as spectacular in orthopaedics, with total joint replacements currently leading the race, really stem from the fact that we have not understood the basic causal mechanisms of most diseases. We do not know why rheumatoid arthritis destroys joints or why articular cartilage degenerates. So we resort to fire-fighting methods. As a cynic put it, a joint replacement is really an internal amputation, a defeat. Our ignorance exceeds our knowledge. If we understood the basic mechanisms of these diseases, such expensive methods would not be needed.

What we need is more science, not this sophisticated yet profoundly primitive 'half-way technology' which we mistake for high-science medicine. It is in this respect that the biomechanical school, founded by Pauwel, and practiced by his followers, offers joint preservation techniques by well-chosen osteotomies at the hip or knee, which need to be understood and more widely practiced.

Let us try to understand the inexorable march of what Fuchs has called "the technological imperative", a tendency to take action, whatever the cost, if it offers even a slight possibility of utility. Einthoven has expounded on what he terms 'flat of the curve' medicine — the medical variation of the economic law of diminishing marginal returns as inputs into a system continue to increase. Medicine should consider the possibility of contributing more by doing less.

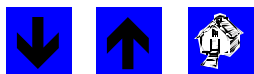
Treatment of fractures

I am disturbed by the frequency with which under the influence of the AO school, fractures are being treated by operative fixation. I am disturbed not merely because of an unacceptable incidence of post-operative infections which leads to so much misery, but

because of a new kind of colonisation of our minds, aided by subtle marketing strategies, to make us believe that fractures would not unite unless rigidly fixed. The fact, however, is that most fractures unite with perfectly simple and safe conservative measures. I pay my tributes to the AO school which has been responsible for elevating the standards of fixation with exquisitely engineered implants in fractures which do require operative fixation. But I question their views on the biology of fracture healing. You would all have encountered the ivory hard, avascular bone, which is revealed when an AO plate is removed. It is a sorry spectacle when contrasted with the exuberant, almost riotous ensheathing callus reminiscent of a sarcoma which John Charnley illustrated in his thoughtful *'Closed treatment of common fractures'*. While the AO group has, of late, been forced to modify its earlier stand, most of us are still struck by its earlier teachings. By the time its new message trickles down to us, many patients would have become victim to this fallacy.

The old equation so persuasively taught by our great fracture pundits, Bohler and Watson-Jones, that accurate anatomical reduction is equal to good functional result, was effectively challenged by Nicolof Mansfield and George Perkins. Perkins introduced a system of rating fractures: one star fractures could be treated by any doctor while three star fractures should only be tackled by experienced orthopaedic surgeons in a well equipped hospital. This approach has great merit. His slim text on fractures and his Robert Jones lecture, *Rest and movement*, has great relevance in the Indian situation.

The abominable standards of asepsis in most Indian hospitals do not detract young surgeons from using power tools whose whine so excites their psyche that they behave like adolescents revving up the throttle of a 500 cc motorbike to a ton-up lad. The scenario reminds one of children playing with toy guns, with the same joyous



expression on their faces. 'Fixation is fun' is the title of an editorial written by Apley in JBJS which should be compulsory reading for our residents. Such is an example set by us to our undergraduates and residents that they have no idea about conservative methods of treating fractures, have never seen a Thomas splint, do not know anything about managing modified Russell traction and have not heard of the Trueta method of closed plaster treatment of open fractures which they would now treat by external fixators.

Let us remember that the bad results of operative treatment of fractures are much worse than the bad results of conservative treatment. WE should not be bewitched by our 'best case scenarios' and forget our 'worst case scenarios'. High technology should remind us of the well-known nursery rhyme: "when she was good she was very, very good, but when she was bad, she was horrid."

AO courses on internal fixation at Davos are marvelously organised. It is time for us to conduct similar courses on conservative management of fractures with the same finesse. It would not be easy. The market situation would be against such attempts. However, I encounter many bright and idealistic young minds who are capable of taking such challenges.

Another recent example of how useful advances, aided and abetted by media coverage and our own greed, get misused is seen in the use of arthroscopy. Judiciously used, and after spending a long period of apprenticeship under a great master, it is a worthwhile addition to our diagnostic and therapeutic armamentarium. But the recklessness with which arthroscopic clinics are sprouting up like beauty parlours, performing arthroscopic lavages and shaving articular cartilages in osteoarthritic knees, has made our large population of painful knees captive victims to an outrageously expensive but wholly irrational and meddling procedure.

Education of orthopaedic surgeons

I think it has now become our duty to seriously review some of the foregoing distortions which are rapidly invading our profession, and to constantly sensitise our students to concepts of cost-benefit analysis. Economists could be invited to teach them about poverty. There are a number of outstanding doctors who have been working in peripheral areas and achieved more than we ourselves could achieve under their circumstances. How many of us know of, much less inform our students about, the work of Raj Arole and NH Antia, of Zafarrullah Choudhary in Bangladesh or Prawaye Wasi in Thailand? There are activist organisations like Medico Friends Circle who can instill a lot of idealism in our younger generation. Our undergraduates ought to be exposed to them and certainly our COE programme can have a guest lecture each year by some of these and I make this suggestion in all seriousness. This can help restore some awareness about the needs of the bottom 90 per cent of rural and urban poor, instead of the increasing trend to use elitist technologies geared to the demands of the top 10 per cent of our urban elite.

There is an Indian Association of Rural Surgeons. Having attended one of their annual conferences, I was astonished to learn how much can be done in rural areas where none of the trappings of modern urban hospitals are available. We need to exchange notes with them and I am sure this step would be mutually beneficial.

Delegation

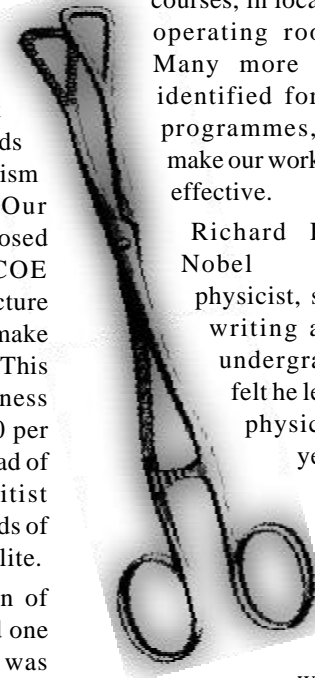
Caring for everyone requires that the ordinary tasks of medicine be delegated to the humblest and cheapest member of the team capable of doing it effectively. Such auxiliaries as orthopaedic assistants and rural medical aides need to be trained on a wide scale, to delegate tasks to them and then to supervise them carefully.

Dr Antia is already doing this in the field of plastic surgery and Dr Arole in the practice of rural medicine. Managing the provision of such care is now one of the most critical tasks in medicine. It was said by a professor who started his career teaching post-graduates, continued it teaching undergraduates and ended it teaching auxiliaries, that he found the last task the most difficult, the most valuable, the most creative and the most rewarding.

I am glad to find that Dr Taneja, with the encouragement of Dr Mukhopadhyaya, has started courses, in local languages, for operating room assistants. Many more areas can be identified for such training programmes, which could make our work easier and more effective.

Richard Feynman, the Nobel Prize-winning physicist, spent two years writing a textbook for undergraduates and he felt he learnt more about physics in these two years than in the rest of his career. Hassan Fatthy, the father of modern Egyptian architecture, wrote a gem of a book entitled Architecture for the poor. I have been pleading with Prof. Mukhopadhyaya to write a similar book on orthopaedics for the poor. I am convinced he would find that this contribution could be more challenging, creative and satisfying than all the earlier work he has done.

It is only when one fully understands a subject that one can arrive at simple solutions. Whenever our solutions are complicated, one can take it that the problem has not been understood. It must also be appreciated that technology for the poor cannot either be second-rate or trivial because it invariably poses the tough challenge



of having to be what economists call 'zero cost'. It is a call for "Back to basics".

Please remember that our most distinguished economist, Amartya Sen, sitting in the rarefied atmosphere of Harvard or Cambridge is working on poverty. He is not toeing the line of the World Bank economists bullying India to close public hospitals and hand them over to the corporate sector, who would then set up profit-making five-star hospitals with loyalties to shareholders rather than patients.

I end by listing seven axioms worked out by Maurice King in his chapter in the Oxford textbook of medicine and whose title I have unashamedly borrowed for my lecture. This chapter should be compulsory reading for all doctors to be able to understand the economic consequences of using expensive technologies in a poor country.

"Care for all men"

"Create a judicious health service delivery system"

"Teach"

"Delegate"

"Apply the most cost-effective technologies"

"Go widely rather than deeply"

"Make the community master"

The main point I have tried to make is that in a dual society such as ours — and this is true of all developing countries — we are constantly confronted by a Hobson's choice. The technologies evolved in the West are preferred by our rich urban elite who really constitute the market forces influencing our decision makers and western trained professionals. The poor are outside the market forces and have no voice. To permit the poor to escape from this dilemma, scientists and technologists must generate new options, each more effective than the traditional, and more accessible than the modern. Ideally, the options should constitute a hierarchy of technologies with upward compatibility. Then, with rising incomes, the poor can climb from a cheaper options to a costlier option.

Only in such a situation will the people have genuine choices. Thus the role of scientists and technologists is to be option-generators and choice-wideners.

A constant reminder of Maurice King's seven axioms would breed equity in our patient care rather than widening the gulf between rich and poor which is what we are currently engaged in. Patient care, after all, means 'caring for the patient'.

I do not want to be misunderstood. I am not advocating a return to the past, to swadeshi in an obscurantist or fundamentalist manner. Progress is inevitable and desirable if tempered with wisdom. But what goes on under the garb of progress is often misleading. We have to ask the question squarely: progress for whom and progress for what? We have too many clever surgeons today. What we need to resurrect is that class of wise surgeons who can relate their work to the needs of a very complex society. Surgeons like Prof. Mukhopadhaya are rapidly becoming an endangered species. It should be our endeavour to preserve, protect and nurture his heritage.

Suggested reading :

1. Antia, N H: Reconstruction of the face in leprosy, *Annals Of the Royal College Of Surgeons Of England*, 32:71, 1963
2. Antia, N H, Kavita Bhatia: *People's Health In People's Hands*, The Foundation For Research In Community Health, Bombay, 1993
3. Arole, Rajanikant and Mabelle Arole: *Jamkhed: a comprehensive rural health project*, Jamkhed, Distributed By Orient Longmans (Isbn 81-900. 590-0-2), 199
4. *Aspects of science and culture: essays and tributes in honour of Dr. B Mukhopadhaya*, Patna. Printed by Bihari Block Printing Works, Ed. S P Ghosh, 1992
5. Banerjee, J K: *Concept and practice in rural surgery*; B I Churchill Livingstone Pvt. Ltd. New Delhi, 1993
6. Bhattacharya, S: Method of mobilisation of the post traumatic stiff elbow - Paper presented at the Annual Meeting Of Association Of Surgeons, Baroda, 1965. Cited in *Clinical Surgery Orthopaedics*,

Ed Rob and Smith, Vol 12, P 420, Butterworths, London, 1967

7. Choudhary, Zafrullah: Basic service delivery in underdeveloping countries: a view from Gonashasthaya Kendra; In *Readings on poverty, politics and development*, Ed Kamla Bhasin and Vimala R, Fao Rome, 1980, Page 179

8. Cousins, Norman: *Human options*, Berkeley Books, New York, 1983

9. Cousins, Norman: *The healing heart*, Avon Books, New York, 1984

10. Enthoven, A: Cutting cost without cutting the quality of medical care. *New England Journal Of Medicine*, 298:1229, 1978

11. Gould, Donald: *The medical mafia*, Hamish Hamilton, London, 1985

12. Ilich, Ivan: *Medical nemesis*, Calder and Boyars, London, 1985

13. King, Maurice H: Medicine in an unjust world, In *Oxford Text Book Of Medicine*, Vol. 1 3.3:3.11, Oxford University Press, Oxford, 1983

14. Mukhopadhaya, B: *The role of excisional surgery in the treatment of bone and joint tuberculosis*: Huntarian Lecture, Royal College Of Surgeons Of England, 1955

15. Nandy, Asish and Shiv Vishwanathan: *Modern medicine and its non-modern critics: a study in discourse in dominating knowledge*, Ed. F A Marglin and S A Marglin, Clarendon Press, Oxford, 1990

16. Perkins, George: *Fractures and dislocations*, The Athlone Press, London 1958

17. Reddy, A K N: Appropriate technology for rural development. Keynote address in *Appropriate technology for primary health care*, Indian Council Of Medical Research, New Delhi, 1981

18. Sacks, Oliver: *A leg to stand on*, Picador, London, 1984

19. Shapiro, S and Wyman, S: Cat Fever. *New England journal of medicine*, 294:954 1976

20. St. Claire Strange: *Debunking the disc*: Presidential Address, Orthopaedic Section, Proceedings Of The Royal Society Of Medicine, 1971

21. Taylor, Richard: *Medicine out of control: the anatomy of malignant technology*, Sun Books, Melbourne, 1979

22. Tomas, Lewis: *The lives of a cell: notes of a biology watcher*, The Viking Press, New York, 1974

