Orthopaedic Trauma Relief in Africa- an Odyssey: Part 2b
The search for answers in the journey of hip joint implant arthroplasty in sickle cell joint disease – ten years down the road with Motec

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Introduction

*About ten years ago (October 2006) a team of six British volunteers belonging to UK based registered medical charity made a maiden working visit to Ghana full of enthusiasm, ambition and hope. The group planned to **M**ove resource personnel from UK to Ghana, provide **Or**thopaedic-**T**rauma Training, **E**ducation and relief, **C**ounting on the experiences of the Combined health workforce of **UK** and target hospitals in Ghana. There was an apparent support from UK based orthopaedic companies and members of the British public. A charitable chain of working visits to Ghana and sub-Saharan Africa including exchange programmes between the sub-region and British health workers from various health institutions have continued and remain alive. That charity considered all aspects of Life and eventually named the organisation **MOTEC** Life - UK. The key British Orthopaedic manufacturing companies have been Corin Limited UK and De Soutter Medical.*

Motec's team at maiden visit to Ghana October 2006

As part of the experience of the first team visit to Ghana in October 2006, I reflected on the trip and described a long and tortuous adventure (part one of the odyssey- www.moteclife.com). I narrated the sad common story of Girdlestone hip arthroplasty as the primary surgical care for arthritic hips (practiced in Ghana) which made the patients walk and sway in agonising pain a few years after the procedure. I can now write with joy that the

common practice at that time, through education and exemplary work by Motec has now been successfully confined to history. Motec will continue to campaign for the abolition of Girdlestone arthroplasty as a primary treatment of hip joint where arthroplasty in indicated and in places where the surgical services can be safely provided. The benefits of arthroplasty have transformed the mentality of the patients and their carers including the orthopaedic surgeons in the West African sub-region. Arthroplasty for severe disabling joint diseases has now proven to be an acceptable practice for quality of life especially in the young patients who are in their productive age (often bread winners) in the sub-region. This opportunity is now playing a significant role in returning them into a socio-economic productive group and contributing to the wealth of their families and national economies. In the current form that Motec operates, the horizon is being transformed in the sub-region's orthopaedic world. The trauma and orthopaedic relief odyssey has been nurtured into a live wire for training of hospital staff of all grades including, peri-operative nursing, physiotherapists and orthopaedic surgeons. It has generally been an all-inclusive capacity building in both basic and hi-tech surgical management of common orthopaedic trauma pathologies in sub-Saharan Africa. (Other areas including spinal orthopaedic surgery, breast cancer care, nutrition rehabilitation in the malnourished children, safe casting, peri-operative nursing have been added on successfully.)

The working strategy has included workshops, hands-on live surgeries, exchange training programmes for Ghanaian anaesthetists, orthopaedic trauma surgeons coordinated by Motec motivated by a consortium of patrons including Lord David Alton of Liverpool (chair in good citizenship). For the past three years, World Orthopaedic Concern UK has come alongside Motec to deliver training and education in West Africa. Motec being a non-profit organisation, and as such any funds that are generated by the services in the hospitals is ploughed back into an on-going improvement in the hospital healthcare delivery thus improving the facilities for healthcare and improve patient experiences. As a result of the experiences of Motec in the sub region, the charity has set up a road map for the policy makers in Ghana to consider implementing to promote availability of specialists and trauma implants in order to help improve trauma care. The sad loss of our key ally, the late President John Mills of Ghana, has left a palpable gap in our 'quest for basic trauma product manufacturing' potential. The trauma factory proposed to the government of Ghana by Motec which was also intended to provide employment for the people and clinical materials for use in trauma is now slumbering in the files of the President of Ghana and the High Commission in London.

Other areas of work continue to grow. The capacity building campaign objectives of Motec span across teaching at nursing training institutions (5 colleges), teaching hospitals (3 main ones) and support in the improvements in the standard of exit Fellowship Examinations of the West African College of Surgeons in collaboration with the World Orthopaedic Concern-UK and the London postgraduate school of surgery. Local training programmes by Motec have been backed by attachments for orthopaedic surgeons, anaesthetists and nurses from Ghana in institutions in India and England. From a practice era of excision arthroplasty for young arthritic hip, Motec has encouraged joint arthroplasty in Ghana when indicated and early fixation and mobilisation of fractures that need surgery. The country now has an increasing steady flow of arthroplasty surgeries by local surgeons in Ghana on patients from the West African sub-region including Gambia, Nigeria, Liberia, Sierra Leone.

The acceptance of the practice by surgeons and the success experienced by the patients have all led to a constant flow of NGO surgical teams from Holland, USA, Italy, United Kingdom and Germany in support of hip and knee arthroplasty in Ghana. This is happening against the background of frustrating remarks such as 'arthroplasties should not be performed in Ghana' from some of these organisations in the early phase. My concern at that time was where to send these patients for treatment and how to source funds for their care and travels. Step by step approach guided by the history and some of the lessons learnt in the practice of arthroplasty in the developed world played a major role in the working strategy. The joint arthroplasty numbers treated by Motec since the inception of the project has risen beyond five hundred and hence Motec's recent initiation of a joint registry in Ghana, the first of its kind in sub-Saharan Africa

Orthopaedic Trauma Project

Motec Life UK in collaboration with the World Orthopaedic Concern - UK has developed a tradition of hosting national and regional workshops in orthopaedics twice a year in Ghana and three clinical working visits since 2007. These activities also include the provision of clinical services and training in joint arthroplasty and trauma management in target institutions including Koforidua St Joseph's, Akosombo VRA and the Military Hospital in Accra. The striking pathologies seen and treated through the collaboration with these target institutions include sickle cell hip joint disease, infected and non-infected fracture non-unions, mal-unions all of which account for a significant proportion of the debilitating diseases in the sub-region.

Special Interest

As the clinical lead in the orthopaedic project, one of my main areas of interest is the improvement of the journey of the young arthritic hip patient with sickle cell avascular necrosis in the sub-region. This write up provides a summary of the observed personal views and highlights some of the challenges of arthroplasty in sickle cell avascular necrosis of the hip.

Arthroplasty project

From the modest number of two joint arthroplasties the first visit in October of 2006, Motec with local staff in Ghana now perform about 65 hip and knee arthroplasties each year in three centres in Ghana. These hips and knees are done in almost equal numbers. There are striking differences between the hip pathologies seen in Ghana and the UK with about one in three from sickle cell avascular necrosis and another one in five from arthritis secondary to joint infection and or trauma, the rest from degenerative hip diseases in Ghana. In UK, Majority is from degenerative joint disease. The wider picture of the survivorship of hip joint arthroplasty in sickle cell avascular necrosis is a subject under review and ongoing work by Motec may provide one of the biggest reviews of joint arthroplasty in sickle cell hip disease.

The microcosm in the macrocosm in sickle cell disease

Sickle cell disease (SCD) is prevalent among the indigenous people of Ghana. The disease refers to a group of conditions characterized by the presence of haemoglobin S (HbS) and one other abnormal hemoglobin especially Hb C. The genotypes characterised by Hb SS and Hb SC are dominant in the sickle cell disease population of Ghana and form the major group of patients that come in for arthroplasty in our project in Ghana with the occasional SD and S-Thalassaemia. Global estimates in 2010 show that children born with SS alone was about 312,000. Sub Saharan Africa accounts for about 75% of the global burden of SS diseases (1& 7). It is therefore not a surprise to face a challengingly high numbers of sickle cell disease hips in Ghana. Like many other chronic diseases, SCD has a huge socio-economic impact on people and sub-Saharan Africa. One in three Ghanaians has the hemoglobin S and/or C Sickle cell gene. The homozygous state results in an abnormal hemoglobin that is prone to crystalisation under cellular deoxygenation. The polymerized hemoglobin reduces red blood cell deformability and causes "sickling" of erythrocytes within capillaries and end-arterioles. The resulting microcirculatory obstruction gives rise to vaso-occlusive crises which may occur repeatedly in the presence of certain

triggers. Clinically, the disease is characterized by chronic hemolytic anemia interspersed with episodes of acute vaso-occlusive sickling crises which is the underlying pathogenesis of sickle cell avascular necrosis. In the "stable state", most patients with Hb SS have a steady state hemoglobin level of 8g/dl. Hb SC patients tend to have a higher steady state hemoglobin level of about 11g/dl but more frequent tissue infarctions (e.g. avascular necrosis of the femoral head). Most studies show a high failure rate of joint arthroplasty in sickle cell disease as well as high medical complications (3. Clarke et al, JBJS Br) and an unhealthy bone marrow coupled with new bone formation within the bone marrow in response to the infarction may explain the apparent high failure rate.

Our knowledge about the behaviour of sickle cell bone marrow disease should be a guide in our decision making to fit an artificial implant in that 'medium'. Come to think of the preparations we have to make in the developed world - we endeavour to take our patients through pre-op assessment and optimisation in order to minimise the risks and complications of our surgery. It is therefore important to consider patient selection as an important step in achieving best results. Some selection criteria must therefore be considered for sickle cell diseased bone and joint disease. The questions we have to consider should include the following:

- How can we tell if a sickle cell bone marrow is stable and healthy enough to support a prosthetic implant? Also how can we predict clinically the state of health of a bone marrow in an environment where sophisticated bone marrow studies are not readily available and if there are, could add a prohibitive cost to arthroplasty surgery?

- If sickle cell bone crises can influence osteo-integration at the interface between bone and the artificial implant, be it cemented or uncemented, then questions need to be asked regarding the optimal time to implant the prosthesis.

- Since infection risks is important to consider in joint arthroplasty and if infection and or parasitic infestation can be a cause of bone crisis affecting bone marrow biology, and in the setting of sickle cell disease, should malaria anti-malaria treatment dose or prophylaxis be considered a priority in these group of patients in addition to correction of dehydration, hypoxia and appropriate pre-op nutritional status of the patient in addition to antibiotic prophylaxis?

- Are there unforeseen environmental challenges in these group of patients especially if the surgery is done outside their familiar environment and then returned thereafter to their native environment?

- If red cell exchange is considered to be useful in sickle cell joint arthroplasty, how do we get the assured safe utilisation in the sub-Saharan environment? Could patient selection and clinical optimisation in the sub-Saharan sickle cell arthroplasty patient decrease the need for pre-operative red cell exchange transfusion? (Swerdlow et al Red Cell Exchange in Sickle Cell Disease Cancer Inst., 4100 John R 4HW-CRC(5).

- As per Alomran, there is increased risk of loosening of implants in cemented hip replacement in patients with sickle cell disease (European Orthopaedics and Traumatology May 2010, Volume 1, Issue 1, pp 25-29 21 April 2010(4)). Could these increased loosening of implant in sickle cell patients be reduced by considering the use of uncemented prosthesis?

A healthy bone marrow for artificial joint implantation?

We know that it is essential to implant into a healthy bone marrow. The sickle cell disease bone marrow is compromised by the disease but the level of health is often that of a stable one or subject to variations from the effect of conditions like malaria, infections, poor nutrition, dehydration etc. In a low economy environment therefore it is important to define criteria for patient selection that may closely reflect on the health of the bone marrow. A stable haemoglobin can be assumed to reflect on the equilibrium between red cell destruction and the formation within the bone marrow. A fluctuating haemoglobin level even if high in sicklers is assumed to reflect on a struggling bone marrow. It would make sense to check on the Haemoglobin levels of a sickle cell patient over a reasonable period to 'presume' the state of health of the bone marrow. If it is fluctuating significantly then of course the physician has to find the precipitating factors, address them before referring patient back to the surgeon for artificial joint implantation. My observations are that a healthy sickler often has stable Haemoglobin over 12 to 18months.

The number of hospital medical admissions of the patient is also a reflection of the health of the sickle cell disease patient irrespective of the specific reasons for hospitalisation. Often they present with a painful sickle cell crisis precipitated by a triggering factor. It is not surprising that patients with sickle cell anemia who were more than 20 years old, with high rates of pain episodes tended to die earlier than those with low rates(6). It is also gratifying to note that patients with sickle cell disease who survive beyond 18 years have a higher chance of living close to the

national average lifespan (7 -The Scientific World Journal Volume 2013 (2013), Article ID 193252). It goes without saying that sicklers with stable health and bone marrow should be treated with arthroplasty if clinically indicated beyond the age of 20 and that the surgery should aim for long term survivability of the implant.

Bone crisis for sure is an expression of the bone marrow in trouble and the frequency of bone crisis or medical admissions would be an important yardstick with which we can clinically measure a healthy bone marrow. The assumption I have made is that a patient with bone crisis, or medical admissions two or more times a year is likely to have a struggling bone marrow that may not hold your artificial implant well, cemented or uncemented. In the case of a struggling bone marrow where red cell exchange transfusion may be indicated, it is important to counsel patients about the hazards including graft versus host disease (7). To minimise all the risks of red cell transfusion, a safer and affordable approach would be the physicians optimising the patients without the need for red cell transfusion. This approach is likely to help the patients maintain a healthy life in their environment. The adhoc exchanged transfusion may have a role in cases that are resistant to the physician's efforts where the patient continues to suffer from disabling pain. In these cases, a change in the patients' environmental-socio-economic situation may have to be supported in order to rectify the health of the patient and the biological response to arthroplasty.

From success to significance

The statistics on orthopaedic trauma and joint disease in injury and the orthopaedic diseases in Ghana and sub-Saharan Africa still remain 'insufficient and daunting'. To achieve a satisfactory outcome of joint arthroplasty in sickle cell disease in a low income economy, more research will be required to enable patients have safe surgery in their own environment without going through expensive peri-operative measures like red cell exchange transfusion, travel, hotel and treatment costs of the developed world. Help can also be at the doorstep of patients if capacity building is improved. What has changed the past decade is that there has been a dramatic increase in the number of orthopaedic surgeons in Ghana probably from the interest generated from successful treatments and maybe the economic benefit of arthroplasty to the local doctors and patients. The handful of orthopaedic/trauma surgeons in Ghana at the onset of about 15 covering a population of about 25 million has now grown to about 50 for 27 million people over the past 10 years. I am not overtly concerned about skills developed in Ghana for economic reasons by the surgeons as the services are being retained in Ghana and the expected build up of competition will control cost of treatment eventually. There is also the urgent need for the Western style NGOs supporting arthroplasty in Ghana to help improve

capacity building as opposed to providing personal practice sessions, personal curriculum improvements and media related promotions. We should together concentrate on building capacity and improving infra-structure working with local surgeons and the health authorities in the developing world in order to sustain the project when we finally and completely hand the button over to the local staff in Ghana.

In the final analysis, young people in West Africa where the prevalence of sickle cell disease is high are suffering from debilitating bone and joint disease. As the developed world's attention is skewed on diseases like AIDS, tuberculosis (8) and help for patients like sicklers is not yet 'appealing' to the international forum, it is high time that governments take ownership of projects to support research or create a platform for the voices of the suffering sicklers to be heard. Data to be published soon supports longevity of arthroplasty in sickle cell joint disease on sicklers done locally in Ghana by Motec over the past 10 years, contrary to the perception in the literature.

Another area that NGO's providing arthroplasty surgeries in Ghana could help would be supporting training of the local surgeons and nursing staff as well as backing research to give sickle cell joint arthroplasty a longer survivability. The basic ground rules and patient care guidelines have been set by Motec in Ghana and all those who are partaking in the joint care surgery also have a lot to contribute in helping Ghana provide the lead in sickle cell joint arthroplasty.

Our sincere gratitude to the target hospitals in Ghana, Motec's consortium of Patrons, Motec and World Orthopaedic Concern-UK volunteers, the Director of the London School of Postgraduate Surgery, The West African College of Surgeons, The Ghana High Commission and members of the British Public and Companies who continue to stand by us in our efforts to improve health care in Ghana and sub-Saharan Africa. I am also grateful to my senior Colleague Peter Dyson whose support for Motec as a patron and spinal orthopaedic surgeon has been impeccable. Above all, my sincere thanks to my wife and family who have endured ten years of sacrifices with disruptions in life that has not affected their love for me and indeed have urged me on. We believe that life should count for something good and our mark in our little world when we are no more should centre on our love for humanity. Can I also just say finally that this paper is dedicated to sickle cell disease patients and ardent supporters of Motec who lost their battle against diseases namely the Warrior Princess Zena Bullmore(OBE), George Digby and Doreen Soutter . Our gratitude to The Almighty God who delivers safe passage and guidance to all involved in this project.

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