



■ ANNOTATION: GENERAL ORTHOPAEDICS

The Kenya Orthopaedic Project

SURGICAL OUTCOMES OF A TRAVELLING MULTIDISCIPLINARY TEAM

G. R. Cousins,
L. Obolensky,
C. McAllen,
V. Acharya,
A. Beebejaun

*From Derriford
Hospital, Plymouth,
United Kingdom*

■ G. R. Cousins, BSc(MedSci),
MBChB, MRCS, Specialty
Registrar in Orthopaedics and
Trauma
Ninewells Hospital,
Department of Orthopaedics,
Dundee DD1 9SY, UK.

■ L. Obolensky, MCEM, DSEM,
MRCS, GP Specialty Registrar 3
Southwest Peninsula Deanery,
South Devon NHS Foundation
Trust, Torquay, Devon TQ2
7AA, UK.

■ C. McAllen, FRCS(Orth),
Consultant Orthopaedic
Surgeon
Derriford Hospital, Department
of Orthopaedics, Derriford
Road, Plymouth PL6 8DH, UK.

■ V. Acharya, BMBS,
Foundation Doctor
Luton and Dunstable Hospital
NHS Trust, Lewsey Road, Luton
LU4 0DZ, UK.

■ A. Beebejaun, BMBS,
Medical Student
Peninsula School of Medicine
and Dentistry, John Bull
Building, Plymouth PL6 8BU,
UK.

Correspondence should be sent
to Mr G. R. Cousins; e-mail:
gerard.cousins1@nhs.net

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We report the results of six trauma and orthopaedic projects to Kenya in the last three years. The aims are to deliver both a trauma service and teaching within two hospitals; one a district hospital near Mount Kenya in Nanyuki, the other the largest public hospital in Kenya in Mombasa. The Kenya Orthopaedic Project team consists of a wide range of multidisciplinary professionals that allows the experience to be shared across those specialties. A follow-up clinic is held three months after each mission to review the patients. To our knowledge there are no reported outcomes in the literature for similar projects.

A total of 211 operations have been performed and 400 patients seen during the projects. Most cases were fractures of the lower limb; we have been able to follow up 163 patients (77%) who underwent surgical treatment. We reflect on the results so far and discuss potential improvements for future missions.

The World Health Organization (WHO) has named trauma as the leading cause of mortality worldwide in patients older than five years of age, and has stated a need for a global improvement.^{1,2} In 'Guidelines for Essential Trauma Care', the WHO emphasises the need for improved human resources (staffing and training) and physical resources (equipment and infrastructure).³

It is estimated that there are about 60 orthopaedic surgeons in Kenya, although only 31 are registered with the Kenyan Medical Practitioners and Dentist Board.⁴ This gives a ratio of 1:550 000 at best for the population of 36.9 million, while the WHO recommends a ratio of 1:100 000. The cost of orthopaedic surgery is prohibitive to most Kenyans. Orthopaedic surgical missions to developing countries are rare due to the difficulty in obtaining funds for equipment and its transportation.

The long-term goal of improving and sustaining human and physical resources is one that has not always been achieved by charitable medical missions. We describe a service that offers the opportunity of treatment to those who are unable to afford it and, through a partnership with local healthcare teams, the possibility of improved care for subsequent patients.

Patients who undergo surgery during our visit are subsequently followed up both by the local team and by a returning member about 12 weeks after the main team has left. To our knowledge there are no other reported outcomes for similar missions.

The Kenya Orthopaedic Project

The first Kenya Orthopaedic Project (KOP), in February 2009, was to Nanyuki Hospital Kenya. This followed an invitation for assistance with the trauma load in this district.

The team of 12 included two consultant surgeons, two anaesthetists, three scrub nurses, one operating department practitioner (ODP) and a volunteer student. A side-by-side teaching model was adopted in theatre with Advanced Trauma Life Support⁵ sessions taking place for other medical and nursing staff throughout the hospital. A regional meeting was also held for all doctors in the region where presentations were given from both the United Kingdom and Kenyan teams. The KOP rapidly doubled in size and, currently, each year takes two surgical units to Nanyuki and Mombasa hospitals for a week at each centre. The members of the project take their own operating equipment and leave all instruments and implants for the hospital after use. Members have also arranged for the purchase and transfer of three image intensifiers to the hospitals.

The team now also includes a radiologist and physiotherapist, and has sponsorship from the British Orthopaedic Association for two orthopaedic registrar fellows and for two medical students per project from the Peninsula Medical School.

The benefits of taking orthopaedic trainees has been reported in the orthopaedic literature, not only as an advantage to training, but also a means of integrating a knowledge and interest in global health early in training.^{6,7}

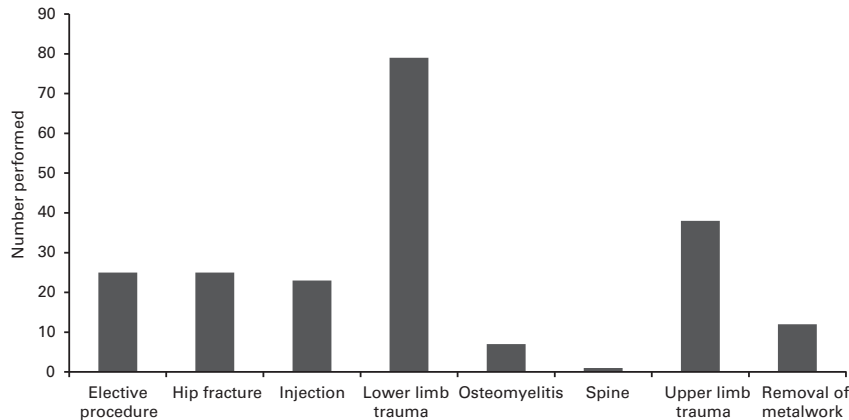


Fig. 1

Bar chart showing the procedures performed in all six missions.

The trauma burden is huge in Kenya due to poor transport and health and safety measures at work.⁸ As a result most patients operated on are trauma cases. The Kenyan team are involved locally prior to starting the project, and from the outset there is a combined agreement in the aims and objectives. Particular attention is given to what the local team hope to achieve in terms of service and teaching provision. Through our partnership both hospitals are enrolling in the 'African Partnership for Patient Safety', a WHO patient safety initiative.⁹

The first day of the project is spent screening patients and creating operating lists for the week. Much of the screening has been initiated locally by surgeons prior to the team's arrival, with outpatients brought in especially, and potential inpatients highlighted at the first ward round. Before finalising the operating lists for the week ahead, a trauma meeting is held with the local surgeons to discuss all shortlisted cases. Patients are generally prioritised based on the potential for improvement in their pain or function with equipment at our disposal. Patients with fractures of long bones, who would otherwise be left with permanent disability, and therefore be unable to work or raise a family, make up a large proportion of the case mix. Children with treatable congenital pathology and fractures are also prioritised.

The following six days are spent operating. The seventh day is reserved for emergency operations and final ward rounds with clear discharge and physiotherapy follow-up plans. Daily teaching sessions are run in the afternoon for junior doctors, nursing and recovery staff. Scrub and sterile services departmental teaching takes place each morning. A side-by-side teaching model takes place in theatres, and there is a ward round every morning and evening. A member of the KOP surgical team follows up the patients approximately 12 weeks after the visit.

Results

A total of 211 operations have been performed on 187 patients during six missions (three each in Nanyuki and Mombasa). The follow-up service provided by the KOP team and continual contact with the Kenyan surgeons has meant that we have been able to follow up 87% of patients (163 patients). Although most operations have been for trauma, other procedures include sequestrectomy for chronic osteomyelitis, soft-tissue stabilisation and injection of arthritic joints (Fig. 1).

There were 60 female patients and 131 male patients; the demographic data were not collected for four patients. Their mean age was 36 years (2 to 96). All operations were performed either by or under the direct supervision of a United Kingdom consultant orthopaedic surgeon.

Hip fractures. A total of 25 hip fractures were operated on. The mean age of these patients was 56 years (15 to 96). There were 12 extracapsular fractures that were treated with a sliding hip screw in all but one, which was treated using a proximal femoral nail. An Austin Moore (B. Braun Medical Ltd, Sheffield, United Kingdom) or Thompson's (Stryker UK Ltd, Newbury, United Kingdom) prosthesis was used when a hemiarthroplasty was required. An excision arthroplasty was required in two patients due to intra-operative technical difficulties. A total of 14 patients were followed up; ten were described as doing well by the reviewing surgeon despite abductor weakness in one and a post-operative infection in another. Of the other four patients, two died more than 30 days after surgery, aged 91 and 96 years, one fracture had failed to unite at ten weeks and one patient had persistent contralateral knee pain and abductor weakness.

Lower limb trauma. Most operations (79; 77 patients) were for lower limb trauma. Fixation of femoral fractures accounted for 32 lower limb operations (41%) and tibial

Table I. The distribution of the 79 lower limb operations performed

Operation*	Procedures (n, %)
ORIF femur	21 (26.5)
ORIF ankle	6 (8)
ORIF tibia	7 (9)
IM nail femur	12 (15)
IM nail tibia	9 (11)
Above-knee amputation	3 (4)
Arthrodesis ankle	2 (2.5)
External fixation tibia	2 (2.5)
Joint washout	2 (2.5)
Talectomy	1 (1)
Manipulation under anaesthetic	2 (2.5)
Tendo Achillis tenotomy	1 (1)
Tension band wire (patella)	5 (6)
Wound debridement ± closure	4 (5)
SUFE pinning	2 (2.5)

* ORIF, open reduction and internal fixation; IM, intramedullary; SUFE, slipped upper femoral epiphysis

fractures for 13 (16%) (Table I). Two above-knee amputations were undertaken for infected open tibial fractures and one for tuberculosis. In all, 12 injuries (15%) have been recorded as open, although records for this have only been kept since the project to Mombasa in 2010. There have been 49 operations since then, suggesting a total of 24% (i.e 12 of 49 cases) of fractures being open as a more representative figure.

A total of 19 patients (25%) were lost to follow-up. Of the remainder, 41 (53%) were reported as doing well at the 12-week review, five were mobilising well but needed physiotherapy, four remained partial weight-bearing due to lack of physiotherapy guidance, one was non-weight-bearing and needed physiotherapy, one had a prominent nail but was otherwise progressing well, two had moderate residual pain on mobilisation, two had delayed union and there were two surgical wounds that remained unhealed. All other wounds healed satisfactorily. Of the patients with an open fracture, four were lost to follow-up.

Upper limb surgery. A total of 38 operations in 36 patients were performed for upper limb trauma, including three manipulation under anaesthesia (MUA) for distal radius fracture, one open reduction, one closed reduction and two anterior stabilisations of the shoulder, four fixations and one application of a brace for humeral nonunion, one removal of a foreign body, two fixation, one open reduction and exploration and one examination under anaesthesia of the elbow/distal humerus; three excisions of the radial head, one fixation of a Monteggia fracture/dislocation, seven fixations of the radius and ulna, four of the ulna alone, an arthrodesis of the thumb, one metacarpal and one phalangeal fixation and three wound explorations with tendon repair. A total of 11 patients (29%) were lost to follow-up. Of those reviewed, 18 patients were described as doing well and seven were doing reasonably well but had a reduced range of movement. In most cases this was reduced

supination/pronation after forearm fixation and it was felt physiotherapy would be of value. The patient with an open dislocation of the elbow had more severe limitation of movement. The Kirschner-wire used for temporary stabilisation of the elbow became infected and had been removed with no known subsequent dislocation. One of the humeral fixations remains under regular radiological review to confirm union due to delayed healing.

Elective surgery. The elective cases can be split into diagnostic (examination under anaesthesia (EUA) with or without image intensifier (six cases)) or therapeutic. There were six epiphysiodeses, two ankle fusions, two Achilles tenotomies, a decompression of the shoulder, and excision of the lunate and three tibial osteotomies. Only one elective operation (an epiphysiodesis) was performed in 2011. All patients have been discharged other than the one who underwent epiphysiodesis who requires monitoring until metalwork is removed, and one who underwent a tibial osteotomy that developed a pseudarthrosis and required further surgery.

Injection. A total of 23 patients received a steroid and local anaesthetic injection; 14 for osteoarthritis of hip or knee, three for plantar fasciitis, two for carpal tunnel syndrome, one for osteoarthritis of the wrist, one for tenosynovitis at the ankle, and one each to a fracture of the hip and knee for analgesia at the fracture site.

The outcome of four are unknown (including those following fracture), otherwise all were doing well with the exception of one patient with severe bilateral osteoarthritis of the hip and one with osteoarthritis of the knee, both of whom only derived three weeks benefit from the injection.

Removal of metalwork. Metalwork was removed from 12 patients due to local symptoms; all did well except one who suffered a further fracture through the site of previous osteomyelitis, which was treated non-operatively, and two superficial infections.

Osteomyelitis. A total of seven patients have undergone surgery solely for osteomyelitis, with sequestrectomy or incision and drainage; five involved the femur, one the tibia and one the forearm. Of these, two are doing well and the others remain under review for persistent infection.

Spine. One patient with a fracture of the spinous processes of C5 and C6 underwent an examination under anaesthesia with fluoroscopy to confirm the stability of the injury; he was doing well at follow-up.

Discussion

These procedures were performed in non-laminar flow theatres with sterilisation techniques below the United Kingdom standard. The complexity of the cases was much greater than that encountered in more developed countries. In order to ensure the greatest benefit and the best outcomes appropriate patient selection is essential. This is not easy due to the large number of patients, the inherent complexity of the cases and the expectations of the local orthopaedic team and population as a whole.

The mean age of the patients who sustained a fracture of the hip was lower than that encountered in the United Kingdom (56 years *versus* 77 years).¹⁰ Half of these patients were < 53 years of age and those followed up were found to be doing well. It is hoped the increasing availability of physiotherapy will improve the mobility of the older patients who suffer a femoral neck fracture, although the mobility of these patients may remain limited despite this treatment.¹¹ We intend, in the future, to concentrate the surgical treatment of femoral neck fractures on younger patients.

The lower limb trauma cases again varied from those encountered in the United Kingdom, where there is a bimodal distribution of young men and old women.¹² In the Kenyan context most patients are young males with high-energy trauma. The incidence of open fractures of long bones in the United Kingdom is estimated to be approximately 11.5 per 100 000 population,¹³ with 40% affecting the lower limb.¹⁴ We do not have a record of Gustilo-Anderson classification¹⁵ or the length of time before debridement and definitive fixation, which makes meaningful analysis difficult; however, only two of 12 patients had wounds that remained a concern, although a further two required above knee amputation.

The patients who had sustained upper limb trauma seemed to do well but with a high number (seven of 27) having limited movement. It is hoped that the availability of early post-operative physiotherapy will improve this. Some limitation of movement seems inevitable due to delayed presentation in many of these patients.

As a group we have moved away from operating on patients with elective conditions as it is felt that the greatest benefit is obtained through reconstructive surgery in patients after trauma. Our aims are to return as many patients as possible to high function so they are able to work in order to support their families and the wider community. Much of the elective work can be done by the local surgeons with whom any difficult cases are discussed. We offer the patients with osteoarthritis specialist physiotherapy for the week we are there with parallel training of the Kenyan physiotherapists and pain relief with steroid injections.

Chronic infections and amputations are increasingly being managed by the local team as close monitoring and support is best offered by them. This is reflected in our results on a small number of patients.

We believe strongly that the follow-up provided by KOP is essential. It provides continuity between visits with the local team and patients and allows us to evaluate outcomes. Until now these data have been collected informally using terminology such as 'doing well' with any complications noted. This is due to time limitations in the clinic. Tick-box outcome proformas would be quick to administer and give an objective way of determining outcome. Telephone follow-up using such a *proforma* is to be used this year to

allow review of patients who live a long distance away or who cannot afford transport to the hospital. Pre-operative scoring, in particular of Gustilo-Anderson classification for open fractures, would help evaluate the results. Outcome scores, such as a visual analogue score for pre- and post-operative pain, would also provide valuable feedback. As the number of procedures increases over the years, the KOP intends to develop a scientifically rigorous database.

In conclusion, the need for orthopaedic care in the developing world is vast and ways of improving the situation are plentiful. The Kenya Orthopaedic Project is an example of a collaborative effort that aims to engage with local surgical teams and improve their resources. Follow-up is an essential component of the project. Our results so far are encouraging and have helped guide future projects.

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