

Audit of management of open fractures at Queen Elizabeth Hospital

Attempting to close the 'Audit Loop'

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ABSTRACT

An Audit of the management of open fracture at Queen Elizabeth Central Hospital (QECH) was conducted from April 2000 to October 2000. A series of guidelines were adopted to improve care and outcome of patients. Reanalysis of management and outcome was conducted to 'close the loops' of audit. Improvements were noted in early management in casualty audit and in getting patient to theatre early. There was a reduction infection rate from 20% to 9% for cases coming directly to QECH and from 71% to 50% for referral cases. For cases coming directly to QECH those getting surgery within six hours of admission improved from 35% to 67%. Infection rates in referral patients remained high because less than 30% of patients had debridement prior to transfer and the majority of the patients were transferred between two to ten days after injury. The guidelines were recommended as standard management of open fractures at QECH and should be adopted at all hospitals. If possible compound fractures should be debrided at the referring centre before transfer to central hospitals, especially if they cannot get to the central hospitals within 6 hours of injury.

INTRODUCTION

One of the philosophies of medical audit is that the result of audit must influence medical practice. Measurement of performance is of use only if it identifies areas of concern and the results of the audit stimulates appropriate change and recommendations. To 'close the audit loops' a reanalysis of medical practice after the recommendations is necessary to assess if the intended outcomes are being achieved.

This paper describes, the audit management of open fractures at QECH. The current practice at QECH was audited; recommendations in management were made and the management practice was reaudited to assess adherence to the recommendations and improvement in outcome.

This audit was precipitated by several observations: the perceived high number of infected open fractures on the orthopaedic wards at QECH; the delay in getting compound fractures to theatre for definitive treatment and the lack of

treatment guidelines of open fractures in casualty.

METHODS

The current practice of management of open fractures at QECH was audited from 1st April 2000 to 30th June 2000. Consecutive patients with open fractures were enrolled. Based on the audit findings and using evidence from the literature¹, a set of recommended guidelines (Table 3) for management of open fractures was made. These guidelines were made known to all

Table 1: Patient details recorded

- * Name, age, sex
- * Time and date of injury
- * Mechanism of injury
- * Bone injured and Gustilo grade of the open fracture
- * Whether patient came directly to QECH or was referred and treatment given at the referring centre
- * Date and time of arrival in casualty at QECH
- * Initial management in casualty at QECH
- * Date and time taken to theatre at QECH for definitive treatment and type of definitive treatment done.
- * Subsequent operations
- * Complications especially infection rates

Table 2: Modified Gustilo and Anderson Classification Of Open Fractures

- Type 1: Simple open fracture with a clean wound <1cm long
 - Type 2: Open fracture with a laceration >1cm long; without extensive soft tissue damage, flaps or avulsions.
 - Type 3: Open segmental fracture; open fracture with extensive soft tissue damage or traumatic amputation.
- A: With adequate soft tissue coverage of bone.
 - B: With inadequate soft tissue coverage of bone.
 - C: With major arterial injury.

orthopaedic / general surgery department staff and were sent to all district hospitals with advise on the importance of debriding patients prior to transfer and the importance of early referral of patients. A month after instituting the guidelines, the second phase of the audit was started. Consecutive patients with open fractures presenting from 1st April 2000 to 31st October 2000 were enrolled. Patient details recorded are as shown in Table 1. The Gustilo and Anderson^{1, 2} classification of open fractures is summarised in Table 2.

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The recommended guidelines for management of open fractures are as shown in Table 3.

RESULTS

66 patients (77% males) were enrolled in the first phase of the audit, 39 patients (92% males) were enrolled in the second part of the audit. The age distribution of the patients is shown in figure 1. Causes of injury are as shown in figure 2. The tibia was the commonest bone fractured in both phases of the audit

were being treated at the district hospitals and only the more severe and complicated cases were being referred to QECH. The majority of the patients that came directly to QECH were Gustilo grade 1 (41%) and Gustilo Grade 2 (32%). In the second part of the audit the severity of injuries were more similar between the referred and non-referred patients. Distribution for Gustilo grades 1, 2, 3A, 3C, were 19% and 7%, 38% and 33%, 29% and 33%, 14% and 17% respectively for non referred and referred patients.

Table 3: Recommended guidelines for management of open fractures

Fractures received directly to QECH

1. Patients with open fractures have limb threatening injuries and must be treated as urgent cases and given priority over all patients except those with life threatening injuries
2. In casualty such patients should be assessed for other injuries; the pulse, blood pressure, and respiratory rate should be documented, and resuscitation given where appropriate.
3. The wound should be fully exposed, cleansed of all gross contamination and dressed with sterile gauze soaked in antiseptic solution.
4. The limb should be splinted.
5. Intravenous access should be established and 1g IV chloramphenicol given.
6. Analgesia, preferably intravenous, should be given.
7. Tetanus toxoid 0.5 ml IM should be given, or tetanus immunoglobulin 500 units IM in cases of gross contamination.
8. Where possible, an x-ray should be taken prior to debridement, but if a delay will be incurred then debridement should proceed without x-rays.
9. Debridement should take place in theatre under suitable anaesthesia, within six hours of arrival in casualty. Patients should be treated as emergencies and not wait for fasting period to elapse.
10. Debridement, where possible under tourniquet, should include surgical excision of all devitalised tissue, extension of the wound to expose and cleanse the both bone ends and thorough irrigation with Ringer's lactate or normal saline.
11. The wound should be left open.
12. The bone must be appropriately stabilised by external fixation, plaster of Paris, traction, or internal fixation depending on the skills and facilities available.
13. Antibiotics should be continued for a minimum of 48 hours.
14. The wound should be inspected at 48 hours and redebridement undertaken if necessary.
15. The aim is to achieve skin coverage within 5 - 7 days from injury.

Fractures received as referrals from other centres

1. If the fracture occurred within 24 hours of arrival at QECH, it should be treated according to the guidelines for fractures presenting directly to QECH.
2. Patients arriving more than 24 hours after injury should have their wound inspected, wound swab taken, and antiseptic dressing applied. Intravenous antibiotic and IM tetanus toxoid should be given. The limb should be splinted or placed in traction and an x-ray taken. The limb should be debrided on that daytime operating list after negotiating with the relevant surgeon. If a patient arrives after 5pm, the wound should be debrided on the daytime list the following morning.

as shown in figure 3

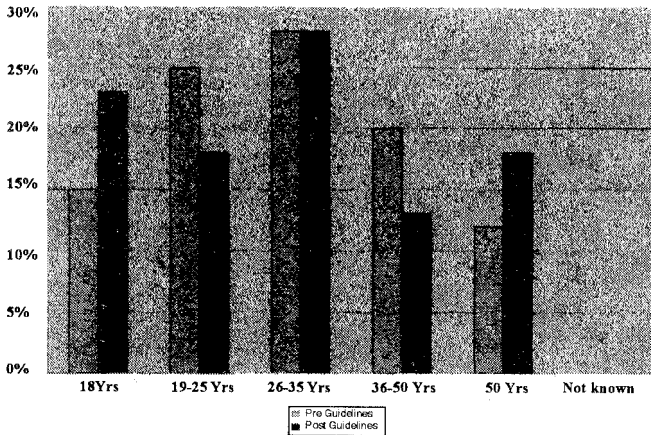
The Gustilo classification of the fractures were analysed for referred and non-referred patients in both phases of the audit. These are shown in figures 4 and 5. In the first phase of the audit it would appear that patients with higher Gustilo grades were being referred to QECH. Among the referred patients 46% were Gustilo grade 2 and 37% were Gustilo grade 3A. This could be a reflection of the fact that the less severe injuries

Infection rates

Figure 6 shows the infection rates. Infection rates were worked out for referred and non-referred cases before and after institution of the guidelines. For non-referred cases, the infection rate improved from 20% to 9% after the guidelines were adopted. In the first part of the audit 71% of referred cases

got infected. In the second part of the audit the infection rate in referred cases was 50%.

Figure 1: AGE DISTRIBUTION



Casualty Management

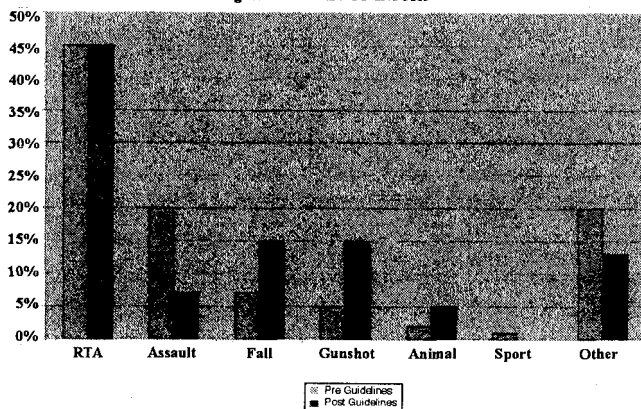
Initial management in casualty was audited by assessing whether a selected list of activities in the guidelines were carried out in casualty. Figure 7 shows management in casualty before and after setting up the guidelines. Prior to setting up the guidelines, no patient received parenteral antibiotics or analgesics in casualty. Only about 40% of the patients had the wound irrigated; covered with an antiseptic dressing; and the limb splinted before leaving casualty. 60% of the patients had tetanus prophylaxis and only 15% had vital signs recorded in casualty.

After the guidelines were made, 81% of the patients received parenteral antibiotics in casualty. The proportion of patients that had their wound exposed; irrigated; covered with an antiseptic dressing and the limb splinted were 95%, 76%, 76%, and 67% respectively. Prophylaxis for tetanus was improved to 95%. Only 19% of the patients received analgesics. The recording of vital signs before and after the guidelines were made remained low at 15% before and 19% after the guidelines were made.

Time To Theatre

Time to theatre from arrival in casualty was assessed for referred and non referred patients. Figures 8 and 9 show the times to theatre for non-referred and referred patients

Figure 2: CAUSE OF INJURY

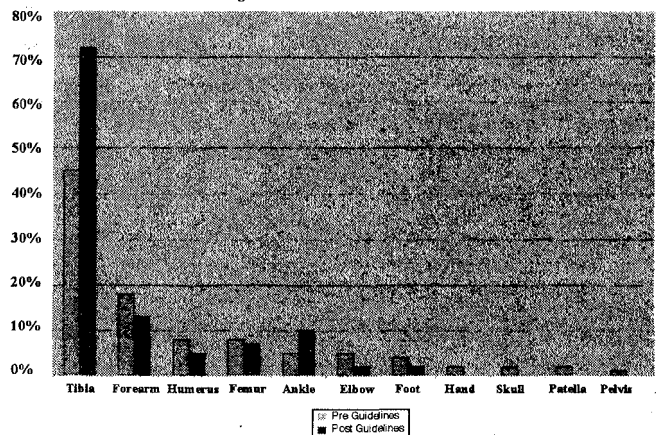


respectively. Prior to setting up the guidelines, only 35% of non-referred patients were taken to theatre within 6 hours of arrival in casualty. 40% of the patients were taken to theatre between 7 and 24 hours after admission and 25% of the patients got to theatre more than 24 hours after admission. After adopting the guidelines, times to theatre for non referred patients improved. 67% of the patients were taken to theatre within 6 hours of admission. 28% were taken to theatre between 7 and 12 hours and 5% between 13 and 24 hours after admission. No patient was taken to theatre more than 24 hours after admission.

Management At Referring Centre And Timing Of Transfer Of Patients To QECH

Figure 10 shows the time from injury to time of transfer of patient to QECH for the referred patients. Both before and after adoption of the guidelines the majority of the patients were transferred to QECH more than 7 hours after the injury. Prior to the guidelines, 4% were transferred within six hours of injury; 38% between seven and twenty four hours of injury and the

Figure 3: COMMON SITE OF INJURY



remaining 42% were transferred between two and ten days after the injury. After the guidelines proposal, 22% were transferred within six hours of injury, 28% between seven and twenty four hours and 78% between two and ten days after the injury. Figure 11 shows the proportion of referred patients who had adequate debridement prior to transfer to QECH. Prior to the guidelines proposals only 14% of patients were debrided prior to transfer to QECH. After the guidelines were proposed still only 28% were debrided prior to transfer to QECH.

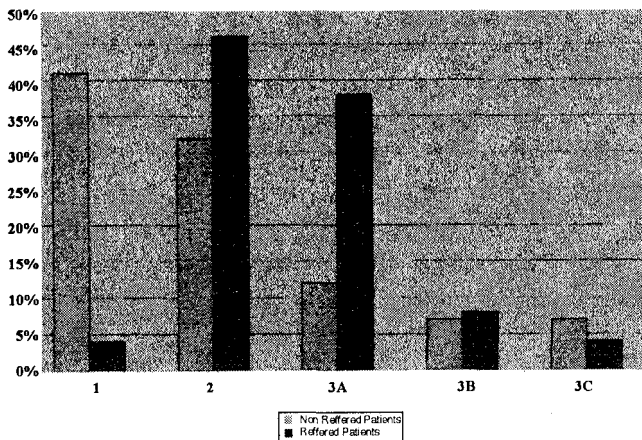
Types Of Definitive Treatment

Following debridement and copious irrigation, bone was stabilised by internal fixation, external fixation, skeletal traction or plaster of Paris (POP). Non-viable limbs following severe injuries were amputated. Figure 12 shows the frequency of the various types of treatment. The majority of the fractures (mainly tibia) were stabilised by either POP or external fixation. In the first part of the audit relatively more external fixations

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(36%) were applied compared to POP (21%), whereas in the second part of the audit more fractures were stabilised with POP (67%) compared to external fixation (27%).

Figure 4: GUSTILLO CLASSIFICATION: Pre Guidelines



Grade Of Surgeon

Figure 13 shows the grade of surgeon doing the procedure. In the first part of the audit consultants did relatively more cases than Orthopaedic Clinical Officers (OCO) and registrars. Consultants did 45% of the procedures and OCOs and registrars did 30% and 15% of the procedures respectively. In the second part of the audit, the trend was reversed with OCOs and registrars doing most of the procedures. OCOs and registrars did 67% and 18% of the procedure respectively. Consultants did only 10% of the procedures.

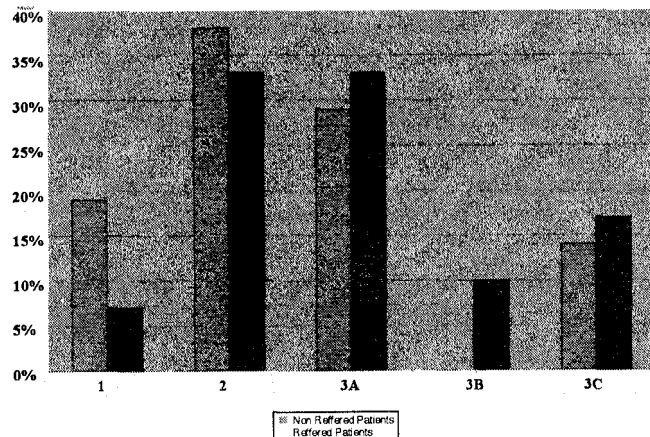
Type Of Anaesthetics

Most of the procedures were done under general anaesthesia. Considering that most of the fractures were in the tibia; it is surprising that not more cases were done under regional (spinal) anaesthesia. (Figure 14)

DISCUSSION

This audit has attempted to address the problems associated with management of open fractures at QECH. The problems areas were: inadequate initial management in casualty; delay in getting to theatre for definitive treatment and referred patients

Figure 5: GUSTILLO CLASSIFICATION: Post Guidelines



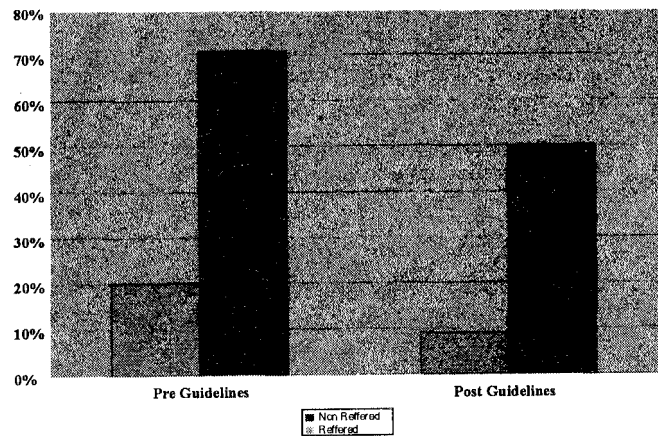
arriving late at QECH having had no prior debridement before transfer. Recommendations were made and a reassessment was done to evaluate the changes in clinical practice and outcome. The characteristics of the patients, causes of injury and severity of the injuries were similar during both phases of the audit. This makes it more likely to attribute the changes in outcome to the recommended guidelines. By reassessing our clinical practice following the recommendations we have 'closed the audit loop'.

The measurable outcome we chose to evaluate was infection rates. The infection rates were worked out as overall figures for all open fractures as the number of patients was small to sub classify them with respect to severity of injury. Prior to institution of the guidelines, 71% of all referred cases and 20% of cases that came directly to QECH got infected.

After the guidelines were adopted 50% of referred cases and 9% of cases that came directly to QECH got infected. For cases coming directly to QECH this is a remarkable improvement in outcome as far as infection is concerned. Possible contributing factors to this improvement could include:

- * Improved initial treatment in casualty. After instituting the

Figure 6: INFECTION RATES



guidelines, administration of parental antibiotics improved from 0% to 81%. Wounds that were exposed, irrigated, covered with antiseptic dressing and splinted improved from 40% to a high of 95%.

- * Improvement in the time from arrival in casualty to time of definitive treatment in theatre. After adoption of the guidelines, the proportion of patients coming directly to QECH, who got to theatre within six hours of arrival in casualty improved from 35% to 67%.

Improvement in casualty management was achieved by posting the guidelines in the casualty department and ensuring that the department was stocked with adequate supplies of intravenous cannulae, intravenous antibiotics, tetanus prophylaxis, irrigation fluids, sterile gauzes and POP splints. Improvement in getting patients to theatre early was achieved by emphasising the urgency of early (<6 hours) debridement of compound

fractures. Colleagues in general surgery and in anaesthetic departments were negotiated with to allow open fractures take precedence over other non life threatening emergencies. This was a very big challenge to overcome as QECH has a chronic staff shortage and there is always competing priorities with other patients requiring laparotomies and caesarean sections for instance. Recording of vital sign in casualty and administration

Figure 7: CASUALTY MANAGEMENT AT QECH - Non Referred Patients

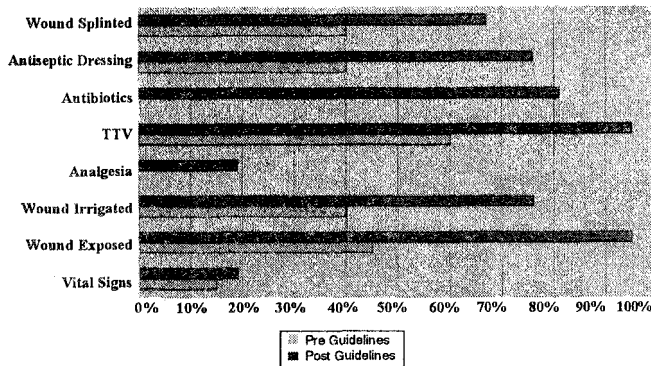


Figure 8: TIME TO THEATRE FROM ARRIVAL IN CASUALTY: Non Referred Cases

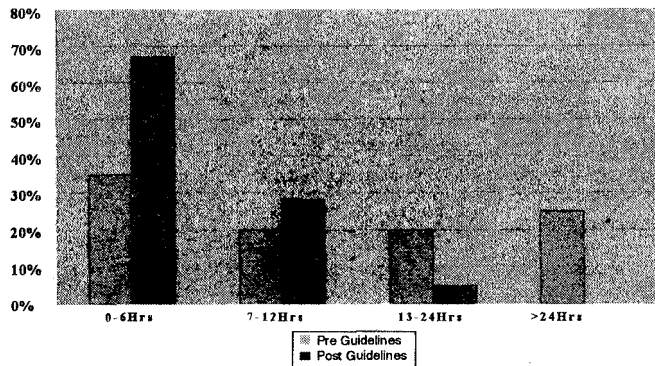
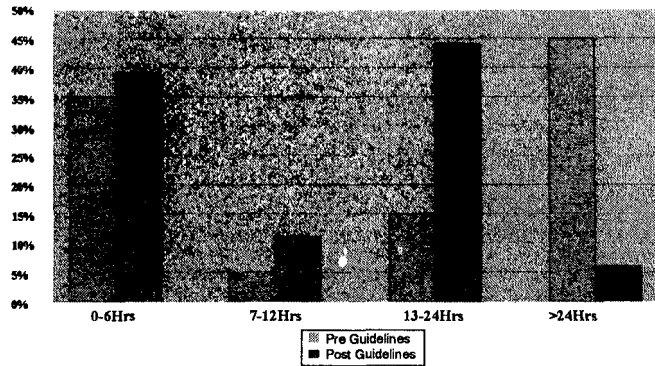


Figure 9: TIME TO THEATRE FROM ARRIVAL IN CASUALTY: Referred Patients



of adequate parenteral analgesics in casualty remained poor. This is attributed mainly to lack of blood pressure machines and thermometers in casualty and to the fact that opioid analgesics are not stocked in casualty. This situation obviously needs to be redressed.

For the referred cases the high infection rates are not surprising when the following facts are considered:

- * Most of the patients are referred to QECH without adequate initial treatment before being transferred. Only 14% of referred patients had wound debridement prior to transfer to QECH in the first phase of the audit. The figure was 28% in the second phase of the audit.

- * The majority of the patients are referred to QECH between two to ten days after the injury. Thus open fractures were staying well over forty eight hours having had no debridement at all before transfer to QECH.

Treatment of referred cases at QECH had also shown some improvement after the guidelines were adopted. In the first part of the audit 45% of referred cases were getting to theatre more than twenty four hours after arrival at QECH. This compares with only 6% of patients getting to theatre more than twenty

Figure 10: REFERRED PATIENTS: TIME FROM INJURY TO TRANSFER TO QECH

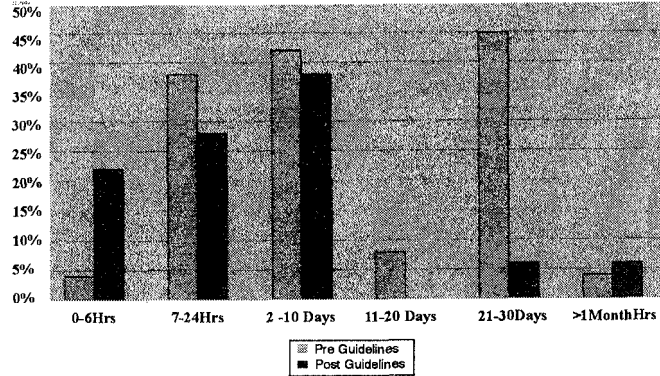


Figure 11: REFERRED PATIENTS DEBRIDED PRIOR TO REFERRAL

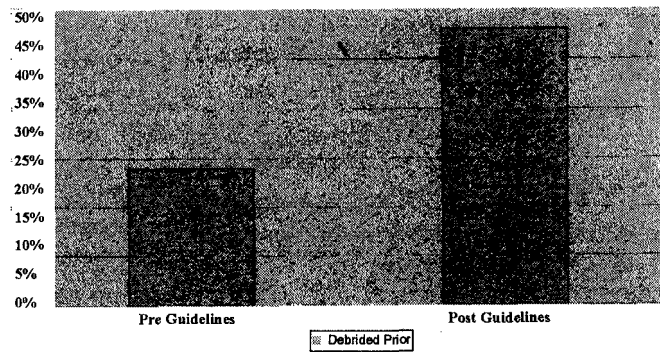
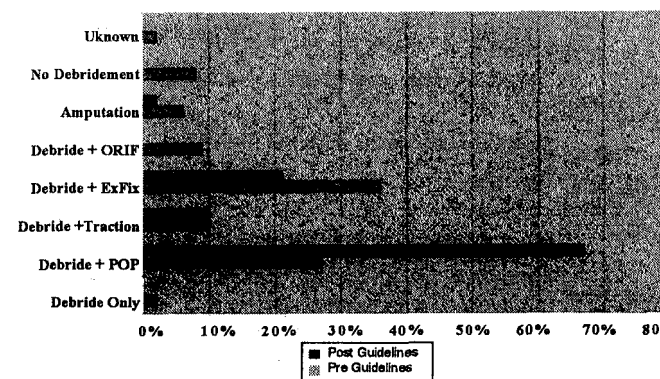
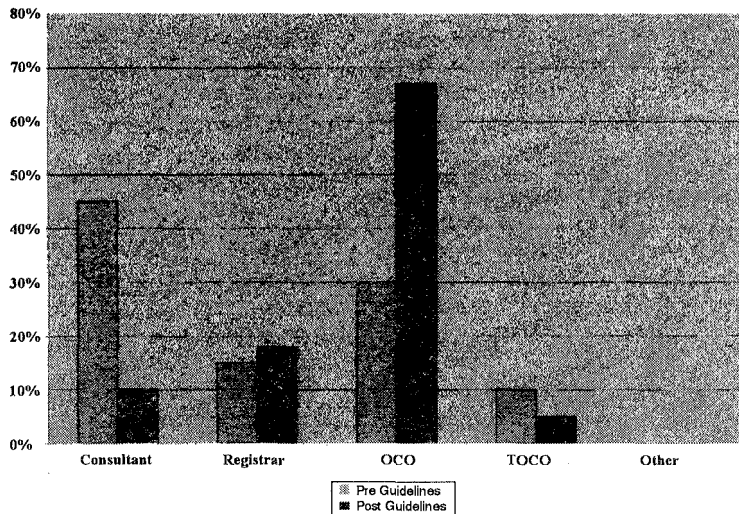


Figure 12: TYPE OF DEFINITIVE TREATMENT



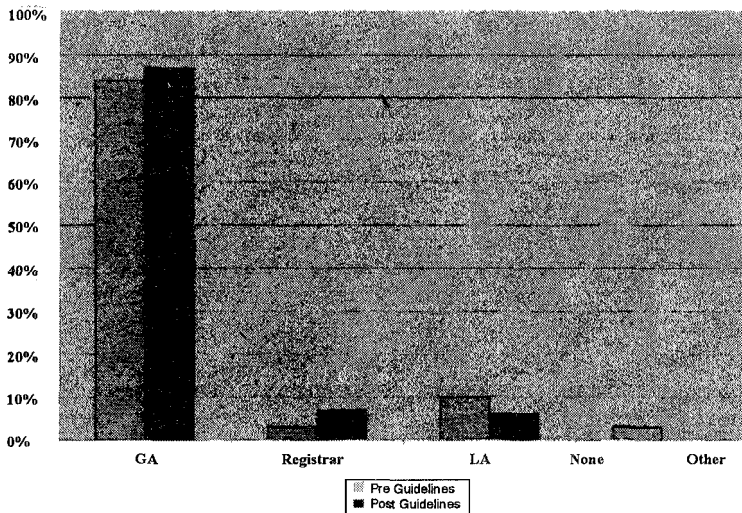
four hours after arrival at QECH in the second part of the audit. The and type of anaesthetic used were also assessed. With respect to grade of surgeon, the notable trend is that this first part of the audit consultants did most of the procedures whereas in the second part, OCOs and registrars did most of the procedures. In the first part of the audit open fractures were treated "semi-electively" and debrided on the next available list

Figure 13: GRADE OF SURGEON OPERATING



usually a consultants list. In the second part of the audit when open fractures were being treated as emergencies (as they ought to be) most of the procedures were being done by on call OCOs and registrars. Generally most patients had general anaesthesia. As most of the fractures were tibia, the small number of patients undergoing spinal anaesthesia is surprising.

Figure 14: TYPE OF ANAESTHESIA



RECOMMENDATIONS

- * The guidelines have shown some improvement in the outcome of fractures coming directly to QECH. These should be adopted as casualty management for open fractures at all hospitals.
- * Patients should have debridement prior to being transferred to QECH and any patient that needs transfer should be transferred as soon as possible preferably within five days of the initial debridement (condition of patient permitting). This would allow early redebridement and facilitate our aim of achieving definitive soft tissue closure within five to seven days of injury.

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2. Gustilo RB, Mendoza RM, Williams DN: Problems in the management of Type 3 (severe) open fractures: A new classification of Type 3 open fractures. J Trauma 1984; 24: 742-746.

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Quarterly Clinic (case report): 200-600 words. Same requirements as Short Report. Please divide the case report into: a first section ending in questions for the reader and a second section with discussion of the case.

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