

Improved Outcome of Fracture Treatment by Early Operative Reduction: Results of a Surgical Audit

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ABSTRACT

An audit is a useful means of examining improvements in the art and science of clinical practice. We applied this to surgery to determine improved outcomes of fracture treatment by early operative reduction. This was carried out at the University of Ilorin Teaching Hospital, Ilorin, Nigeria, by comparing two years, 1997 when there was less emphasis and 1998 when there was a greater emphasis on operative reduction of fractures. Hospital records in the orthopaedic wards, operating rooms and the physiotherapy unit of all patients admitted were reviewed retrospectively. Two years, 1997 and 1998 were analysed for age, sex, type of treatment and quality of outcome. A total of 247 admissions into orthopaedic wards were made in 1997 leading to 79 major operations, 20 of which were operative reduction of fractures (25.3 %). In 1998, 239 patients were admitted out of which 174 major operations were performed, 72 of which were operative reductions (41.4 %, $P = 0.014$). Patients' stay in hospital was shorter in 1998 with 81% of patients staying 3 months and less compared to 40 % in 1997 ($P = 0.000$). Improved outcome of stiff knee joints from physiotherapy was judged good and excellent in 66.7 % and 20 % in 1998 compared to 28.3 % ($P = 0.00005$) and 1.9 % ($P = 0.003$) in 1997, respectively. These results suggest generally improved outcome when fractures are treated by early operative reduction because of shorter hospital stay, early return to work, improved nursing care and joint function. (*Nig J Surg Res 2000; 2:114-122*)

KEY WORDS: Surgical Audit, Operative reduction, Fractures, Outcome

Introduction

Trauma as a disease is a major public health problem at least on two counts. It is the leading cause of death the world over in individuals aged 44 years and less¹. It is also responsible for the great losses to those who survive physical disabilities, emotional upheaval or financial losses to the individual, family or community in unearned income. Therefore, trauma especially in the patient with multiple injuries deserves prompt care to reduce mortality and morbidity. A surgical auditing system is an acclaimed means of evaluating surgical care rendered emphasized as patterned after the Japanese

industrial revolution using the principle of *kaizen*². We observed that in 1998, with the arrival of a new surgeon, there was a greater emphasis on operative reduction of fractures than in 1997. Goris and colleagues³ had noted that generally, improved outcomes are the rule where, the theory of continuous improvement is when fractures are treated by early internal fixation. Several other workers^{4,5} have

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documented extensively over the years the advantages of operative fixation of fractures including early mobilization, improved nursing care, prevention of thrombo-embolic disease, muscle wasting and joint stiffness, prolonged bed rest is avoided and shortened hospital stay is encouraged. Mental inactivity, stress ulcer and perhaps even death are avoided. Our own results have been analysed in this study in the form of a surgical audit. It was originally done to justify the need for more attention to orthopaedics by the hospital management by allocating more of its scarce resources to the unit.

Patients and Methods

The admission and operating room records of all orthopaedic in-patients cared for at the University of Ilorin Teaching Hospital Ilorin between 1st January 1997 and 31st December 1998 were retrospectively studied. The records at the physiotherapy department were also checked to determine the period of physiotherapy especially as it concerns joint stiffness and improvements over a period of four weeks of commencing physiotherapy. The information obtained was studied for age, sex, fracture type and their method of treatment. Where operative treatment was used, the type of operation done was noted. The results have been analysed. In calculating the length of hospital stay which was restricted to long bone fractures, four criteria of exclusion were adopted—those that discharged against medical advice (DAMA), those that requested for referral to hospitals near their places of abode (REF), those that had incomplete data in their records and those that were too financially handicapped to choose an operative reduction of their fractures.

Results

During the period under review, 247 patients comprising 183 males and 64 females (M: F= 2.9: 1) were admitted in 1997 into Orthopaedic wards of the University of Ilorin Teaching

Hospital. In 1998, 239 patients comprising 171 males and 68 females (M: F= 2.5: 1) were admitted. The total number of operations done in 1997 from these 247 patients was 79 giving an operation rate of 32 %. In 1998, 174 operations were done giving an operation rate of 72.8 % of the 239 patients (Figure 1). The types of operations done were analysed in Table 1, which has shown major differences between 1997 and 1998 in the operative fixation of fractures (25.3 % in 1997 compared to 41.4 % in 1998) and skin grafting (5.0 % compared to 13.2 %). However, other types of operations yielded similar absolute numbers just like the admission numbers for the two years suggesting that the years were actually comparable. When the percentages of types of operations were compared, those operations which in 1997 assumed similar absolute numbers with 1998 figures showed lower percentages of total cases done for the year 1998, about half as many, especially for sequestrectomy, corrective osteotomy and limb amputations (26.6 %, 12.7 %, 12.7 % in 1997 compared to 10.9 %, 5.8 %, and 5.8 % respectively). Most of the patients with long bone fractures stayed for 13 weeks and less (81 %) on admission in 1998 as compared to 1997 when patients staying 13 weeks and less constituted only 40 % (P = 0.0000). This is statistically significant (Table 2 and Figure 2). The criteria for exclusion in calculating the length of stay in hospital are four—patients that discharged against medical advice DAMA, those that requested for referral to hospitals near their places of abode, REF, those that had incomplete data in their records and those that were too financially handicapped to choose an operative reduction of their fractures. All cases that had operative reduction of fracture in the two years are listed in Table 3 where there was a 225 % increase in the internal fixation of fractures and a 1400 % increase in external fixation of fractures. Overall, a 360 % increase in the total operative fixation done (20 in 1997 compared to 72 in 1998) shows significant difference. Table 4 shows the number of patients with long bone fractures from which population different forms of

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Table 1: Showing Types of Operations Done in 1997 and 1998

Type of operation	Year of operation	
	1997	1998
Sequestrectomy	21 (26.6 %)	19 (10.9 %)
Amputations	10 (12.7 %)	10 (5.8 %)
Corrective osteotomy	10 (12.7 %)	10 (5.8 %)
Operative fixation of fractures	20 (25.3 %)*	72 (41.4 %)*
Soft tissue surgery	14 (17.7 %)	34 (19.5 %)
Skin grafting	4 (5.0 %)	23 (13.2 %)
Arthrotomy	0 (0 %)	6 (3.4 %)
TOTAL	79 (100 %)	174 (100 %)

Table 2: Showing Length of Hospital Stay for Long Bone Fractures

Hospital Stay In weeks	No. of Patients 1997	No. of Patients 1998	P value
1—4	2 (3 %)	12 (15 %)	0.0156
5—8	5 (8 %)	25 (31 %)	0.0005
9—13	19 (29 %)	28 (35 %)	0.4604
14—17	26 (40 %)	10 (13 %)	0.0002
18—26	10 (15 %)	5 (6 %)	0.0724
Above 26	3 (5 %)	0 (0 %)	0.0170
TOTAL	65 (100 %)	80 (100 %)	

NOTE: Patients staying three months and less (13 weeks and less) =26 (40 %) in 1997 compared to 65 (81 %) in 1998, (P=0.000)

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Table 3: Analysis of Operative Fixation Done

Operative Fixation	Year		% Differential
	1997	1998	
Internal fixation	20	51	225 %
Hemi-Arthroplasty	0	5	500 %
Arthrodesis	0	2	200 %
External Fixation	0	14	1400 %
Total	20	72	360 %

Table 4: Patients with Long Bone Fractures

Patients	Year (%)	
	1997	1998
Excluded	34 (34.3)	28 (25.9)
Operated	20 (20.2)	72 (66.7)
Not operated	45 (45.5)	8 (7.4)
Total	99 (100)	108 (100)

treatment were chosen. Table 5 showed the monitoring of improvement by the degree of change in range of motion in the stiff joint. This is graded poor, fair, good or excellent with increasing degree of motion. The results in 1998 where open reductions were done showed consistently better outcome (Figure 3).

Discussion

A fracture is well recognized as a break in the continuity of bone. The fracture may be associated with injuries to blood vessels, tendons, nerves and the overlying skin. A fracture may communicate across the articular

cartilage into the joint. When the skin remains uninjured, the fracture is described a closed fracture. When the skin is broken, then, it becomes an open fracture, hence there is more to a fracture than just the broken bone. A fracture may be single or double if there are two separate fracture lines in the same bone but at different segments, also called segmental fracture. Fractures are said to be multiple if they involve more than one bone in the same patient. The treatment of fractures for long was by external splinting and a much learning was necessary to do a proper splinting. As operative reduction of fractures became developed and refined in the past decades, due in the main to discoveries in antiseptics, antibiotics and

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Table 5: Showing Knee Joint Assessment at Physiotherapy.

Range of Motion in Degrees (°)	1997 Initial Assessment	1997 4 Weeks After Initial Assessment	1998 Initial Assessment	1998 4 Weeks After Initial Assessment	P Value Comparing 4 Weeks Assessment
Excellent (0-120°)	0 (0 %)	1 (1.9 %)	5 (8.3 %)	12 (20 %)	0.003
Good (Less Than 100°)	3 (5.6 %)	15 (28.3 %)	21 (35 %)	40 (66.7%)	0.00005
Fair (Less Than 50°)	32 (60.4%)	28 (52.8%)	25 (41.7 %)	7 (11.7 %)	0.000002
Poor (Less Than 25°)	18 (34.0 %)	9 (17 %)	9 (15 %)	1 (1.6 %)	0.007
Total	53 (100 %)	53 (100 %)	60 (100 %)	60 (100 %)	

Figure 1: Showing Patients Admitted and Operated

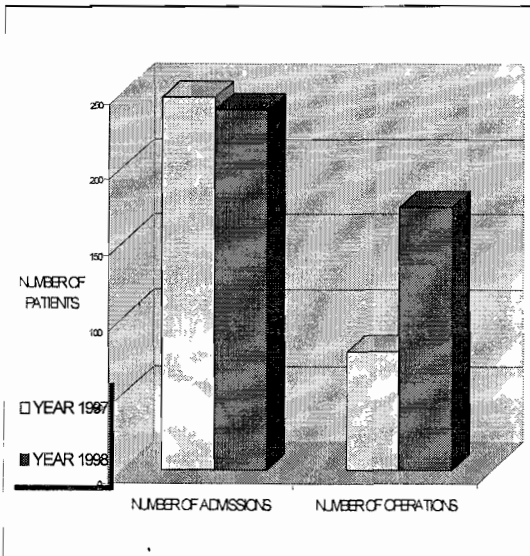
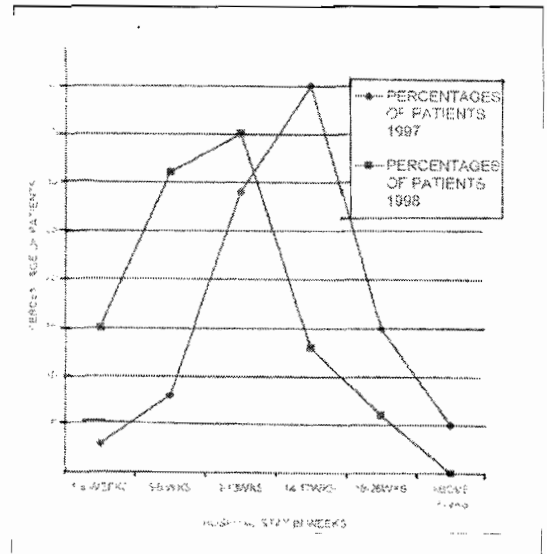
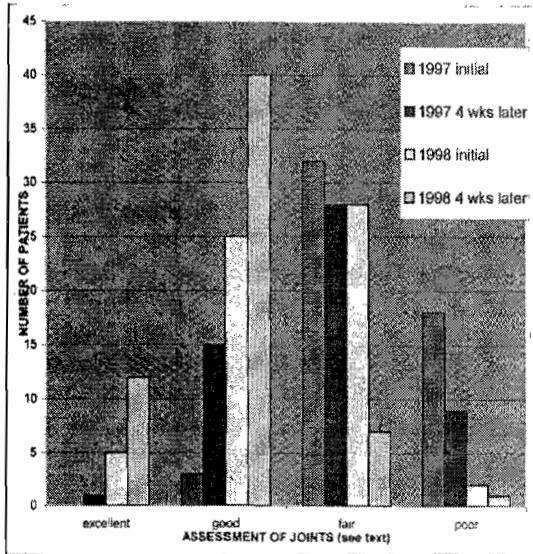


Figure 2: Showing relative Length of Hospital Stay



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Figure 3: Showing Knee Joint Assessment at Initial and 4 Weeks of Physiotherapy



anaesthesia, surgeons have taken preferential positions for either operative or non-operative reduction of fractures. However, several studies have shown that greater benefits ensue from operative reduction of fractures^{3,4,5}. Following the principle of continuous improvement in the care we render to our fracture patients, a documentation of the findings of a surgical audit is necessary, especially in the developing country where a many fractures are still treated inadequately or mismanaged both by physicians and untrained bonesetters as shown by Katchy and colleagues⁶. Where physicians are concerned, both operative and non-operative means of fracture management should be imbibed with the relative advantages each method offers appreciated. Rowley⁷ from Scotland, United Kingdom in his contribution "How should we manage fractures?" said: "Well, the short answer is 'properly'. This really means appropriately and does not mean one way in general; there is no panacea for fractures. Arguments about the 'fixation' school or the 'conservative' school or even the nailing or the external fixation philosophical group are as absurd as they are erroneous. Some fractures do

well if fixed, and others do perfectly well if not fixed. It is worth remembering that taking all things into account, nature gets it right 98 % of the time...". This position is simplistic and tends to suggest that fracture is just about a broken bone and ignores the possibility of multiple fractures and their attendant complications or the varieties of patients who just must be mobile and would lose a much by being in bed and not pursuing their businesses. Rowley⁷ himself gave a fuller answer by recognising that there are many ways of managing fractures, "some of them (options of treatment—operative or non-operative) should be reserved for certain types of fractures, others can be used interchangeably and the fracture will do well under a different range of treatment". Generally, fracture management aims at returning the limb to the pre-fracture state as soon as possible and with little or no complication through appropriate care and rehabilitation. This is best guaranteed by operative reduction in skilled hands. The confusion that may surround deciding which management style to adopt for a particular fracture has been settled by the prescription of Alan Graham Apley in his book⁸. When adopted, certain advantages are obtained in fracture fixation and these form the basis for the improved outcome noted in 1998 as compared to 1997. Apley described three classes of operative reduction of fractures: fractures that the surgeon 'must' operate, 'should' operate, and 'could' operate. Apley had recommended certain other fractures for non-operative reduction especially if the operative skills of the surgeon or inadequate back-up facilities dictate so. These would be the fractures another surgeon with expertise and good facilities will treat operatively. These ones constitute the "could" operate fractures. There are some fractures that only if the surgeon is skilled and he has facilities to manage them that he should opt to treat because the only credible treatment is operative—these are the "must" operate fractures. For example, intra-articular fractures, fracture neck of femur in the elderly, fractures associated with vascular and / or nerve injuries.

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Such fractures are better referred to other surgeons with skills and facilities than be kept for non-operative treatment and risk poor outcomes. The "should" operate fractures lie in between these extremes, like multiple fractures or fractures in a multiple injured patient. Despite this simple guide, some 'must' operate fractures are still being given non-operative treatment. This was seen in some of the 1997 series. This realization challenged us to audit our fracture treatment to alert our practice to the desirability of continuous improvement in fracture care. If fractures are treated operatively—the only limitations would be SKILLS and FACILITIES according to Apley—our audit revealed four groups of advantages for the patient, hospital, the training programmes and the community so that conditions that engender the provision of both skills and facilities are not only maintained but also enhanced. This is more so in a developing country like Nigeria where most decisions are based more on "cash available" than on necessity. Patient related improvement could be seen from the shorter stay in hospital and early return to work and improved joint functions (Tables 2 and 5). This is particularly important for the business executive, students and others who benefit from this advantage. What makes this possible is easily discerned—early operative fixation. In this series, 247 in-patients were treated with 79 of them having operations in 1997 and in 1998, 239 in-patients with 172 operations. Figure 1 showed similar admission but different operation figures while from Table 1 it is obvious that the difference came from operative reduction of fractures. As a percentage of total number of patients with long bone fractures, only 20.2 % (20 of 99 patients) in 1997 and 66.6 % (72 of 108 patients) in 1998 had operative treatment (Table 4). Majority of the patients stayed 13 weeks and less in 1998 (Table 2 and Figure 2) and had good joint functions restored in over 80 % of the cases (Table 5). Goris and colleagues³ have pointed out that nursing care is made extremely easy and comfortable for patients with multiple fractures if they are stabilised operatively. For example, "one patients in 1998 suffered a cerebral

contusion with Glasgow Coma Scale Score of 10 on admission, in addition to fractures of the humerus and femur. He had started developing a decubitus ulcer from prolonged lying on a couch in the accident and emergency ward. He had operative reduction of his fractures by the third week when his coma score improved and was discharged by week 14. He returned to his business by week 20." This is the typical outcome of operative treatment. It is persuasive to proffer that open fractures treated in 1997 and were not offered external fixation created a situation that prolonged hospital stay. It is also tempting to suggest that the proportion of patients in DAMA and REF groups was less in 1998 due to the assumed advantage the patients realised they stood to gain by staying for a short time in hospital if they opted for operative treatment.

Hospital related improved outcomes seen in 1998 include better bed use and a higher turn over. Some patients were admitted on the open corridor because all beds inside the main ward remain occupied in 1997. Other advantages include improved use of facilities and effectiveness of the Operation Pack Revolving Fund (OPRF)—a type of revolving scheme similar to the Bamako Initiative used in managing essential drugs use—that guarantees availability of operation materials. The improved use of these facilities generated a better working capital and encouraged purchase of materials otherwise not available to service the fund. Easily noticed, 72 operation packs used in 1998 compared to 20 in 1997 gives a user ratio of 3.6: 1. This fact is important in a developing country like Nigeria where management of theatre services is frustrating to surgeons and patients alike, because of out-of-stock syndrome and prevalence of fake and/or expired materials, like sutures and other consumables. The establishment of this pack-system has solved most of these problems. Operative reduction of fractures, though not intended to service the pack-system, nonetheless, has been helping the system to procure more materials, an unintended advantage.

Training is enhanced both at the undergraduate and postgraduate levels because our centre is a teaching hospital, such that the principles and practice of the skills for the various procedures performed were imparted to students and resident doctors. It could be seen that in 1997 no hip hemi-arthroplasty, Charnley's arthrodesis or external fixation of fractures were done (Table 3). The review of patients' records showed those who would have benefited from such procedures but no reasons were adduced for not adopting these measures. Consequent to the external fixation of fractures done only in 1998 for open fractures, more skin grafting was done compared to 1997 (23 compared to 4 -almost six times as many) to cover exposed wounds after good granulation tissue has been produced. This gave some junior surgeons opportunities to carry out some of these procedures. Our hospital is also an approved training centre for post basic accident and emergency nursing, such that exposing these students to fractures, which are alternatively managed by operation, challenged them to know which cases are to be sent to a teaching hospital. Indeed, the point about training could not be over stressed as some of the patients operated were referred from physicians from the catchment area who probably had limited exposure to orthopaedics. One of the Charnley arthrodesis done was such a patient with fracture-dislocation of the ankle joint placed in Plaster of Paris. A check X-ray requested and seen by the attending physician showed no change in the fracture-dislocation and the doctor held on to the patient for 18 weeks. The patient was brought to the hospital by one of the others treated by us in 1998. Katchy et al⁶ showed this much mismanagement of fractures by trained physicians in their paper on Lower Limb amputations where 25 % of their amputations were physician referrals (30 of 120 patients). Another 25 % amputation rate (31 of 120 patients) were those who left the traditional bonesetters. It is not gratifying for physicians to share an unenviable position with untrained bonesetters over a ten-year period the study was

carried out. This could be argued as good reason why our Nigerian patients have not seen need to visit hospital for fractures when 'the bones heal anyway whether for good or for bad irrespective of where you go'.

Arguably the most important outcome of early fixation of fractures and early return to work is going to come from the community related improvements. Some of the DAMA patients actually visited traditional bonesetters thereafter. In developing countries, a many patients still visit traditional bonesetters for various reasons including one that pretends that fractures heal better and faster with the bonesetters. We are of the opinion that in the long run one very significant way to pass a strong message exposing the fallacy in the belief is to consistently treat fractures better. One of the patients with displaced fractures of the radius and ulna couldn't believe he could go home after 10 days and without an external plaster of Paris. He went on to explain how he refused several attempts from relatives who had urged him to reject orthodox care initially.

Conclusion

Fractures have been with us for a long time. They are unlikely to go away. What we will contend with are more effective ways of managing fractures at the least possible cost and negligible or no complications. Operative reduction of fractures gives a consistently better outcome as, in this study, it has been shown that patients benefit from shorter hospital stay, early return to work, improved nursing care and physiotherapy rehabilitation. Other benefits include improved hospital care of fractures and better use of hospital bed, improved training programmes which have a direct effect on further improving, in a vicious circle, the treatment of fractures and the possibility of influencing people's behaviour in the long run from visiting the traditional bonesetters in the mistaken belief that fractures heal faster or better when treated by the bonesetters.

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