

# Blood loss and contributing factors in femoral fracture surgery

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## Abstract

**Background:** Substantial blood losses frequently accompany orthopedic procedures.

**Methods:** We prospectively noted peri-operative hemoglobin changes in 93 patients undergoing surgery for femoral fracture with an aim of establishing blood loss and related factors.

**Results:** The mean total blood loss assessed 72 hours after the surgical procedure was 3.31 (SD 1.56) units of whole blood. A multiple regression analysis revealed diathermy use and a simple fracture pattern as significant factors in reducing blood loss ( $p < 0.01$ ).

**Conclusions:** Open intramedullary fixation of femur fractures leads to considerable peri-operative blood loss. This can be reduced by use of diathermy during surgery.

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## Introduction

Studies of major orthopedic surgery procedures demonstrate a considerable intra-operative blood loss<sup>1, 2, 3</sup>. The amount of blood loss during surgery varies with patient and institution for a given surgical procedure<sup>1, 2</sup>, which limits standardization of peri-operative blood orders. However, such blood losses are usually controlled by use of appropriate surgical techniques including meticulous cauterization of bleeding vessels with diathermy.

Blood order schedules that result into grouping, cross-matching or holding of blood units which peri-operative use may not materialize<sup>4, 5</sup>, stress the limited hospital blood bank financial and human resources, and limit access of the sparse blood units to those most in need. It is therefore important for each institution to establish the intra-operative blood losses and needs for the various surgical procedures performed in order to increase the efficiency of limited blood supplies. This is particularly important in the developing world. However, it may be difficult to ascertain the appropriate amount of blood loss as this varies with patient, surgeon or institutional factors<sup>6, 7</sup>. Such factors include irrational peri-operative blood transfusions in some institutions which makes it even harder to compute the exact amount of blood lost during surgery. In order to

measure blood loss at surgery<sup>8, 9, 10</sup>, two methods can be used – the direct and the indirect methods. The direct method involves measuring collected blood in swabs, drainage bags and suction bottles, while the indirect method measures blood loss by hemoglobin or hematocrit changes over the peri-operative time.

At Mulago Hospital, a 1500 bed national referral and major teaching hospital in Uganda, whole blood units are routinely transfused during and after orthopedic surgical procedures, the commonest of which is open reduction and internal fixation of femoral shaft fractures. It is a known fact that one transfused whole blood unit of 450mls leads to a 1g/dl elevation in the hemoglobin level measured after full hemodynamic equilibrium at 72 hours after surgery.

The orthopedic department at Mulago Hospital uses the SIGN [Surgical Implant Generation Network] intramedullary nail technique<sup>11</sup> – an open intramedullary locking nail system for internal fixation of femoral shaft fractures. This is performed without use of fluoroscopy or a traction fracture table. The procedure is accompanied by massive intra-operative and post-operative hemorrhage and therefore consumes a substantial amount of blood in the peri-operative time. Unfortunately, there is limited or no information to facilitate or to streamline the appropriate blood orders in this resource limited setting. This has led to unavoidable wastage of blood units especially when such units can not be used within the peri-operative time.

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The objectives of this study are first to determine the peri-operative blood loss during open reduction and internal fixation of unilateral femoral shaft fractures. In this study, peri-operative time ranged from 24 hours before to 72 hours after the surgical procedure. Second, we determined the factors that contribute to this blood loss.

## Methods

### Study setting

The study was conducted in the wards and operating theatre of the department of Orthopedics at Mulago Hospital, the major referral hospital in Kampala, Uganda. Patients with fractures of the femur who present to this hospital do not undergo surgery until after a minimum of five days due to shortages in theater space and staffing. During this time the fractures are maintained under skin traction to control fracture site bleeding and pain. Two to five days before surgery the attending surgeons conduct preparatory pre-operative ward rounds during which they haphazardly make orders for the units of blood to be used in the peri-operative time. This resource constrained hospital has erratic supplies of blood which are competed for by many categories of patients. The shortage of blood often leads to postponement of surgical procedures. If the blood is available in the hospital blood bank, it is delivered to the operating theater a day before or on the morning of surgery and kept in a domestic refrigerator with uncontrolled temperatures until the anesthesiologist requests for it during surgery or 24 to 48 hours after surgery.

### Study design

The study was designed as an open observational and descriptive study. Over a period of 11 months a consecutive cohort of 93 patients undergoing open reduction and internal fixation of unilateral fracture of the femoral shaft, was prospectively followed from the time a decision was made to operate up to three days after the surgical procedure. During this time, the age, gender, fracture type, hemoglobin change in levels measured 24 hours before surgery and 72 hours after surgery, representing blood loss, peri-operative blood orders and use were recorded. We also observed the surgical technique and the use of diathermy for dissection and cauterization during the surgical procedures.

### Inclusion and exclusion criteria

All patients with an isolated fracture of the femoral shaft, sixteen years and older, were included in the study after obtaining a written informed consent. Study recruitment was done at the time when the decision to operate was made by the attending surgeon, who placed peri-operative blood orders. Patients presenting more than one month after the injury, with old non-unions of the femur, for repeat surgery for a fractured femur, with pathological fractures of the femur, with an open fracture femur, with bilateral femoral shaft fractures and patients with multiple skeletal injuries were excluded from the study due to the wide variation in intra-operative blood losses in these groups of patients. Also excluded were patients with medical and surgical comorbidities, patients on cancer chemotherapy, patients with history of a bleeding disorder and female patients in their menses. No patient received any thrombo-embolic prophylactic drug during hospital stay. Patients were randomly allocated to surgeons. The study protocols were approved by the Mulago Hospital Research and Ethics Committee and the Uganda National Council for Science and Technology.

### The SIGN nail procedure

This is a solid and circular inter-medullary locking nail. It has three oval slots, one proximal and two distal and one proximal circular hole. The slots allow dynamization of the locked system to stimulate bone healing while the hole limits migration of the nail in the vertical axis. The nail is fixed without an intra-operative x-ray support (fluoroscopy) since it is supplied with a special targeting device that assists in locating and locking of slots and holes proximally and distally.

### Blood loss

The amount of blood lost due to the surgical procedure was represented by hemoglobin lost (Hb-lost) in the peri-operative time and calculated according to equation 1, where Pre-opHb is pre-operative hemoglobin (g/dl) measured 24 hours before surgery; Post-opHb is hemoglobin in g/dl level measured 72 hours after surgery; BU is hemoglobin in g/dl that was provided by transfused allogeneic whole blood units in the peri-operative time. (1 Unit equivalent to 1g/dl).

$$\text{Pre-opHb} - \text{Post-opHb} + \text{BU} = \text{Hb-lost}$$

.....equation 1.

For patients who did not receive allogeneic blood the amount of blood lost was calculated using equation 2

$$\text{Pre-opHb} - \text{Post-opHb} = \text{Hb-lost}$$

.....equation 2.

### **Blood sample collection**

Following a written informed consent from each of the participants, up to 2.0 mls of blood were collected under aseptic conditions from the cubital vein at the elbow, using a Becton Dickinson vacutainer® system containing EDTA-K<sub>3</sub>. Blood was collected 24 hours before and 72 hours after the surgical procedure when hemodynamic equilibration was assumed to have occurred. The tube was shaken to allow proper mixing of blood with the anticoagulant, legibly labeled with first and given name, age, sex and hospital number of the patient. A laboratory request form for hemoglobin determination was filled by the staff drawing the blood, who delivered both the sample and the form to the hospital central laboratory.

### **Hemoglobin determination**

A technician determined the hemoglobin levels immediately after blood delivery, using the Coulter STKS (Coulter corporation, Hialeah, FL, USA) photometric system (cyanmethemoglobin method). The Coulter STKS was calibrated daily according to the manufacturer's recommendations.

### **Blood use in the peri-operative time**

The decision of the anesthesiologists to transfuse peri-operatively was based on visual assessment of the extent of soaking of the operation swabs with blood and volumes of sucked blood from the operation site. This also depended on the extent of pallor of the finger nail beds, palms and mucous membranes. Whole blood units were used, each measuring 450 mls and equivalent to 1g/dl rise in hemoglobin level.

### **Factors relating to blood loss**

For all participating patients, the x-ray fracture patterns, surgical technique used for fixing the fracture and use of diathermy during surgery were documented.

### **Fracture type**

The fractures were classified into 3 types according to the AO System (*Arbeitsgemeinschaft für Osteosynthesefragen*, an Association for the study of

internal fixation system) which depends on the extent of comminution. Types A (the least comminuted fractures) are simple spiral, oblique or transverse fractures. Types B are wedged spiral, wedged bending or wedged fragmented fractures where Type C (the most severely comminuted) are either complex spiral, complex segmental or complex irregular fractures.

### **Surgical techniques**

All patients (n=93) were operated under general anesthesia, in a supine position and without use of a traction fracture table. The surgical techniques under observation included incising of skin and other tissues and control of surgical bleeding. One group (n=24) involved the use of monopolar diathermy for incising the dermis and other tissue layers and cauterization of bleeding vessels while the other group (n=69) involved the use of a scalpel for all incisions from skin to bone and a standard surgical knot tying for the bleeders. All surgeries were performed through a straight lateral incision for manipulation of the bone segments to achieve reduction and the nails were introduced either antegrade (through the fossa piriformis) or retrograde through the inter trochelia notch of the ipsilateral knee according to the surgeon's discretion. After the bone reduction and fixation with the intra-medullary nail, the inner soft tissue layers were closed with standard absorbable suture materials (chromic catgut number 2 or vicryl number 1) which ever was available. The skin was closed with non-absorbable suture material nylon number 1 in all cases. The surgical procedures were performed by surgeons (n=4) of similar training background and work experience.

### **Statistical methods**

The continuous outcome variable peri-operative blood loss was tested for normality using the Normal Q-Q plot and the Shapiro-Wilk W test and showed a normal distribution.

Total blood losses from patients operated by the same surgeon were not considered as independent observations. We adjusted for this clustering of observation within a surgeon using cluster command in STATA, and obtained robust standard errors for all regression estimates. For analytical purposes, continuous independent variables – age and pre-operative hemoglobin level were categorized as follows; age into quartiles of years (less or equal to 25, 26-32, 33-46 and 47+), while pre-operative

hemoglobin was into two groups (< 12 or more or equal to 12) g/dl.

We used linear regression analysis to obtain unit change in total blood for every unit increase in the independent variable. The linear regression coefficient was interpreted as a mean difference in total blood loss comparing categories of a factor against its referent group. In the unadjusted analysis, all the factors were individually regressed against the primary continuous outcome variable- total blood loss. In the adjusted linear regression model, we included all variables significant at  $p < 0.15$  in the unadjusted analysis, or potential confounder. Statistical significance was assessed with using  $p < 0.05$  or 95% confidence interval for each estimated coefficient in the adjusted or unadjusted models.

All statistical analyses were performed with the help of computer software STATA version 9.2.

## Results

### Demographics

Ninety three patients were recruited presenting with unilateral fracture of the femoral shaft. There were more males 67 (72%) compared to females 26 (28%). Mean (SD) age was 40 (19.4) years, about three quarters were below 47. Mean pre-operative hemoglobin level was 12.6 (range 9.0-17.1)g/dl. Mean preoperative hemoglobin level was higher among males 12.94 (range 9.0-17.1) g/dl compared to females, 12.00 (range 10.5-14.3) g/dl, ( $p = 0.046$ ). Most patients [ $n = 46$  (49.5%)] had type A fracture, where 20 (21.5%) and 27 (29.0%) patients had type B and type C fractures respectively.

Majority of patients, 56/93 (60.2%), were operated by surgeon A, whereas the other three surgeons operated 9, 15 and 13 patients respectively. Sixty nine (74.2%) patients were operated using the traditional surgical dissection and standard surgical knotting for bleeding vessels, while 24 (25.01%) were operated with the assistance of monopolar diathermy for dissection of tissues and cauterizing bleeding vessels (Table 1).

**Table 1: Patient demographics and baseline characteristics**

Variable	Number of patients	Total = 93
<b>Sex</b>		
Male	67	
Female	26	
<b>Age</b>		
Less of equal to 25 years	24	
26-32 years	23	

**Continuation of table 1**

Variable	Number of patients	Total = 93
<b>Age</b>		
33-46 years	23	
47+ years	23	
<b>Pre-operative hemoglobin</b>		
<12 g/dl	41	
Equal or greater than 12 g/dl	52	
<b>Patients operated by</b>		
Surgeon A	56	
Surgeon B	9	
Surgeon C	15	
Surgeon D	13	
<b>Used Diathermy</b>		
Yes	24	
No	69	
<b>Blood ordered</b>		
Yes	59	
No	34	
<b>Surgical technique</b>		
Antegrade	49	
Retrograde	44	
<b>Fracture type</b>		
Type A	46	
Type B	20	
Type C	27	

### Blood use

A total of 42 units were transfused to 26 patients, ten of whom received 1 unit and sixteen received two units each. Among the 26 patients who received blood (Table 2), patients in age group 33-46 years ( $n = 11$ ) received the highest number of transfusions – [18/42 transfused units (42.8%)], while only one unit was administered to patients in the 26-32 year group ( $p = 0.01$ ). Thirty one units were administered to patients with a pre-operative hemoglobin <12g/dl compared to 11 units transfused to patients with a pre-operative hemoglobin  $\geq 12$ g/dl ( $n = 8$ ) ( $p = 0.001$ ). Six out of the 24 (25%) patients who were operated with the diathermy technique for dissections and cauterization of bleeding vessels received 11 units of blood whereas 20 out of the 69 (35%) patients operated with the traditional surgical techniques of tissue dissection and surgical knotting, used a total of 31 units of blood. Seventeen of the 49 (34.7%) patients whose SIGN nails were introduced with an antegrade technique, received 28 units of blood compared to 14 units transfused to the nine of the forty four (20.5%) who underwent a retrograde technique. Thirty three patients did not receive blood, although 70 units had been ordered and cross matched pre-operatively (Table 1).

**Table 2: Variations in blood use by patient and theatre factors**

Factor	patients who used blood (n=26)	number of units (n=42) per patient	number of units	p value
<b>Sex</b>				
Male	17	28	1.62	0.42
Female	9	14	1.56	
<b>Age</b>				
Less or equal to 25 years	6	8	1.33	0.01
26-32 years	1	1	1.00	
33-46 years	11	18	1.64	
47+ years	8	15	1.86	
<b>Pre-operative hemoglobin</b>				
<12 g/dl	18	31	1.72	0.001
Less or qual to 12 g/dl	8	11	1.38	
<b>Surgical technique</b>				
Antegrade	17	28	1.62	0.12
Retrograde	9	14	1.56	
<b>Fracture type</b>				
Type A	11	18	1.64	0.67
Type B	7	11	1.57	
Type C	8	13	1.63	
<b>Diathermy used</b>				
Yes	6	11	1.83	0.86
No	20	31	1.55	

Bold = significant

#### *Blood loss*

Mean hemoglobin level measured 72 hours postoperatively was 9.75 g/dl (range 5.4-16.0). Male patients had a higher pre- and postoperative hemoglobin level compared to the female patients (12.94/10.19 vs 12.00/8.63 g/dl).

Mean total blood loss assessed 72 hours after the surgical procedure was 3.31 (SD 1.56) units of whole blood. A bivariate regression analysis (Table 3) of patient and operation theater variables by total blood loss showed a statistically significant difference in the mean blood loss between male and female; 3.16 and 3.68 units respectively ( $p=0.03$ ). Compared to patients in age group  $\leq 25$  years, patients in 26-32 years group lost less blood, while patients in age

group 33-46 years lost more blood ( $p=0.034$  and  $0.047$  respectively).

Patients operated with diathermy lost less blood compared to those whose operated with the traditional surgical techniques (2.68 to 3.53 units), which was statistically significant ( $p < 0.01$ ). Patients whose SIGN nails were introduced with an antegrade technique lost more blood compared to those with a retrograde technique (difference in mean=0.33 units,  $p=0.02$ ). Fracture type significantly affected total blood loss, where patients with types B and C fractures were losing more blood compared to those with type A ( $p < 0.01$ ). Pre-operative hemoglobin had no significant effect on total blood loss.

**Table 3: Regression analysis of predictor variables of Total blood loss**

Variable	Unadjusted <i>analysis</i>		Adjusted <i>analysis</i>	
	Difference in mean total blood loss	p value	adjusted differentials in mean total blood loss	p value
Sex (Ref - Female)				
Male	0.52	<b>0.03</b>	0.05	0.43
Age (Ref - less or equal to 25 years)				
26-32 years	-0.94	<b>0.03</b>	-0.49	0.20
33-46 years	0.39	<b>0.047</b>	0.37	0.11
47+ years	0.03	0.89	0.07	0.81

Continuation of table 3

Variable	Unadjusted <i>analysis</i>		Adjusted <i>analysis</i>	
	Difference in mean total blood loss	p value	adjusted differentials in mean total blood loss	p value
Pre-operative hemoglobin (Ref - <12 g/dl)	0.18	0.36		
More or equal to 12 g /dl				
Use of diathermy (Ref - No)				
Yes	-0.84	<b>&lt;0.01</b>	-0.81	<b>&lt;0.01</b>
Surgical technique (Ref - Antegrade)				
Retrograde	-0.33	<b>0.02</b>	0.005	0.97
Fracture type (Ref - type A)				
Type B	1.16	<b>&lt;0.01</b>	1.05	<b>&lt;0.01</b>
Type C	1.71	<b>&lt;0.01</b>	1.53	<b>&lt;0.01</b>
Constant			2.85	

The reference is given in ( )

Bold = significant. The bloodloss is measured in units of 450mls.

#### *Factors related to blood loss*

Bivariate regression analysis showed sex, age, use of diathermy, surgical technique and fracture type to significantly affect blood loss. However, following a multiple regression analysis and after adjusting for other significant factors on bivariate analysis, two factors (diathermy use and fracture type) were individually found to influence blood loss. Diathermy use significantly reduced peri-operative blood loss ( $p < 0.01$ ) according to the following model:

Blood loss with diathermy was  $2.85 - 0.8$  (units of total blood loss without use of diathermy). This means that for every unit of blood lost per patients in the group operated without diathermy, there was a 0.8 unit reduction in the amount of blood lost by the group with diathermy.

Likewise, the severity of comminution of the fracture was found to significantly affect total blood loss ( $p < 0.01$ ). Thus, compared to fracture type A, total blood loss in units varied with positive proportionalities and according to the following model:

Blood loss for type B fracture =  $2.85 + 1.05$  (blood loss for type A fracture).

Blood loss for type C fracture =  $2.85 + 1.53$  (blood loss for type A fracture).

This means that for every unit of blood lost in the peri-operative time of fracture type A, there was a 1.05 and 1.53 unit increase in blood loss for type B and type C fractures respectively.

#### **Discussion**

Generally orthopedic procedures are accompanied by loss of larger amounts of blood. This is partly due to the intrinsic difficulty in stopping hemorrhage in a bleeding bone but is also due to patient and institutional factors<sup>12,13</sup>. Our study demonstrates that a substantial amount of blood (up to 3.31 units of 450ml whole blood) is lost due to surgery of fractures of the femur performed in a developing world operating theater. Open reduction and internal fixation of fractures of the femur is still performed widely in the developing world due to shortage of resources to support minimal interventional surgery like closed intramedullary nailing for such injuries<sup>11</sup>. The use of appropriate surgical techniques and facilities like diathermy, fluoroscopy and fracture tables reduces operation time and intra-operative blood loss<sup>14,15</sup>. However, these facilities are not easily accessible in hospitals in developing countries. This explains the higher blood loss among patients whose procedures were performed without diathermy. A similarly higher loss was observed by Kearns et al<sup>15</sup> in their work on hip hemiarthroplasties operated using scalpel alone for incision compared to incisions performed with diathermy. Wu et al<sup>16</sup> have also established a comparatively higher rate of blood transfusion in revision femoral fracture surgeries performed with an open technique. It is anxiety created by these losses that drives attending clinicians sometimes to irrational peri-operative transfusions.

A fracture of the femur is a major traumatic event which provokes a local and systemic inflammatory response that is characterized by activation of circulating granulocytes to produce pro-inflammatory cytokines one of which is soluble thrombomodulin<sup>17,18</sup>. This cytokine binds to thrombin and the formed complex converts protein C into the natural anticoagulant activated protein C which consumes the clotting factors<sup>19,20</sup>. We believe that the delay in the fixation of fractured femurs at our institution with its attendant continued mobility at the fracture site must have been accompanied by sustained production of this cytokine. In addition, open reduction and internal fixation of the fractured femur is accompanied by a second hit phenomenon of more pro-inflammatory cytokine release<sup>18</sup>. This additive effect of soluble thrombomodulin could have lead to excessive natural anticoagulant consumption resulting into disturbed hemostasis hence the observed substantial blood loss among our patients. Abrahan et al<sup>21</sup> in a series of 21 delayed and open intramedullary femoral fracture fixations also found an increased peri-operative blood loss. Their study was conducted in a theater without traction fracture tables or fluoroscopy, which is comparable to our theater situations.

This study has also established that the greater the damage to the bone the higher the peri-operative blood loss. This is due to the fact that open reduction and fixation of severely comminuted femoral shaft fractures is a technically demanding procedure therefore carries a prolonged operation time to achieve a reduction and has an increased tendency to disrupt the endosteal and periosteal blood vessels. Although the other studied patient factors had no statistically significant relationship to the peri-operative blood loss (after the multiple regression analysis), there was a distinct difference in the loss among the different age groups. The observed higher losses among the elderly patients is in line with the advanced age related reduction in haemostatic abilities that are essential in stopping surgical hemorrhage<sup>22</sup>.

There are two main limitations of the present study. First, the differentials in blood losses of patients operated by a particular surgeon were not considered as independent variables so we cannot completely account for the salient difference between individual skills in controlling surgical bleeding. However, this lack of independence was adjusted for in the statistical analyses. Second, due to lack of operational guidelines on transfusion triggers at our institution, the haphazard use of blood by anesthesiologists in

this group of patients could have resulted in the observed high peri-operative blood loss.

In conclusion, isolated femoral shaft fractures in relatively young healthy patients treated by open reduction and internal fixation in a developing world operation theatre, leads to a substantial peri-operative blood loss. The major contributing factors to this loss are; the fracture pattern and lack of standard theater facilities (diathermy) necessary to limit peri-operative blood loss.

Based on the above observations, the administrative structure of Mulago hospital should designs strategies first, to ensure that patients presenting with femoral fractures are operated as they come so as to shorten time between admission and surgical intervention. Secondly, to improve surgical technology by equipping the orthopedic theatres with fluoroscopy, fracture tables and ensuring that diathermy is used as a standard method of controlling surgical bleeding in all cases.

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The study protocols were approved by the Mulago Hospital Research and Ethics Committee and the Uganda National Council for Science and Technology. All patient and staff related data have been anonymised.

Research was conducted at the Department of Orthopedics, Mulago Hospital, the national referral and teaching hospital of Makerere University College of Health Sciences, Kampala, Uganda. The research is part of a PhD study of the prime author

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# Prevalence and risk factors of low back pain among nurses in a typical Nigerian hospital

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## Abstract

**Objective:** The objective of this study was to determine the prevalence and risk factors of LBP among nurses in a typical Nigerian Specialist Hospital.

**Methods:** A cross-sectional study was designed to determine the prevalence and risk factors for LBP among nurses in a typical Nigerian Hospital. A department-to-department enquiry was conducted using a self structured valid and reliable questionnaire.

**Result:** Four hundred and eight respondents (148 [36.27%] males and 260 [63.73%] females) participated in the study. The 12 month prevalence of LBP was 300 (73.53%). LBP was more prevalent among female nurses (68%) than the male nurses (32%). It was also associated with occupational hazard and poor knowledge of back care ergonomics. The prevalence of LBP in MMSH is comparable to levels recorded abroad. However, in this study LBP did not feature as a major cause of sickness absence in the work place

**Conclusion:** It was concluded that poor back care ergonomics is the major predisposing factor of LBP.

**Keywords:** LBP; Nurses; Ergonomics; Nigeria.

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## Introduction

Pain is an unpleasant emotional state felt in the mind but identifiable as arising in a part of the body. In other words, it is a subjective sensation. Pain is a defense mechanism designed to make the subject protect an injured part from further damage<sup>1</sup>. Low back pain (LBP), perhaps more accurately called lumbago or lumbosacral pain, occurs below the 12th rib and above the gluteal folds<sup>2,3</sup>.

Low back pain is a well recognized cause of morbidity in the industrialized world, where several studies<sup>3-6</sup> have reported the occurrence of LBP in general population and occupational settings<sup>7-9</sup>. LBP is a common cause of morbidity in health care workers. Nurses are among the occupational groups within the health service that are vulnerable to LBP<sup>10</sup>.

According to Cesena et al<sup>11</sup> mechanical hazards in the hospitals include LBP from manual lifting (patients in particular) which makes nursing one of the occupations most affected by LBP. Describing the extent of musculoskeletal injury in nurses, survey showed that nurses lost 750,000 days a year as a result of back pain<sup>12</sup>.

Harrington and Gill<sup>10</sup> stated that LBP is the most common cause of early retirement on ground of ill health, sickness absence, job changes and a fall in the work speed among the working population.

Nurses are required to lift and transport patients or equipments, often in difficult environment particularly in developing nations where lifting aids are not always available or practicable. This study was carried out to determine the prevalence and risk factors of LBP among nurses in a typical Nigerian Hospital.

## Method

The study was a cross-sectional survey carried out among nurses in Murtala Mohammad Specialist Hospital (MMSH), Kano, North-West Nigeria. The hospital is managed by Kano State Government Parastatal, the Hospital Management Board a subsidiary of Kano State Ministry of Health. The hospital has in its employment list over 508 registered and licensed nurses and midwives.

## Instrument:

The instrument for data collection was a self structured questionnaire developed by the investigators and validated by a jury of experts involved in the management of LBP (a physician, orthopaedic surgeon, nurse and a physiotherapist).

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The questionnaire sought information on identification, demographic information, prevalence, severity, back hygiene, causes, off duty status, management and duration of LBP. A reliability coefficient of 0.92 was obtained in a pilot study conducted using 50 nurses (age ranged 30-53 years, mean and SD of 37.9 + 8.71 years) at an interval of four weeks using test-retest correlation (Spearman rank order) coefficient method.

**Administration of the Instrument:**

A departmental to departmental administration of the questionnaire was adopted. The investigators administered the questionnaires to about 500 nurses who volunteered to participate in the study. The questionnaires were retrieved as soon as they were fully responded to. This made it possible for retrieving about 408 (81.6%) of the administered questionnaire.

**Data analysis**

The coded responses on the questionnaire were then entered on the computer general purpose coding forms. They were analyzed using Statistical Package for the Social Sciences (SPSS) (Windows Version 10.0 Chicago IL, USA). The results were presented with the use of simple percentage (%), mean and standard deviation (SD). Chi square (X<sup>2</sup>) was used to determine the association between variables. A probability level of 0.05 or less was used to indicate statistical significance.

**Results**

The age of subjects ranged from 25-55 years with mean and SD of 39.20+9.09 years. There were 148 (36.27%) males and 260 (63.73%) females out of which 96 (23.53%) males and 204 (50.00%) females reported LBP; while 52 (12.75%) males and 56 (13.73%) females reported no LBP.

**Prevalence of LBP**

Low back pain presently and within the last 12 months was reported by 300 respondents (73.53%). Of the 300 respondents reporting LBP, 96 (32%) were males and 204 (68%) were females. X<sup>2</sup> showed significant association (P<0.05) between gender (sex) and prevalence of LBP among nurses as shown in Table1.

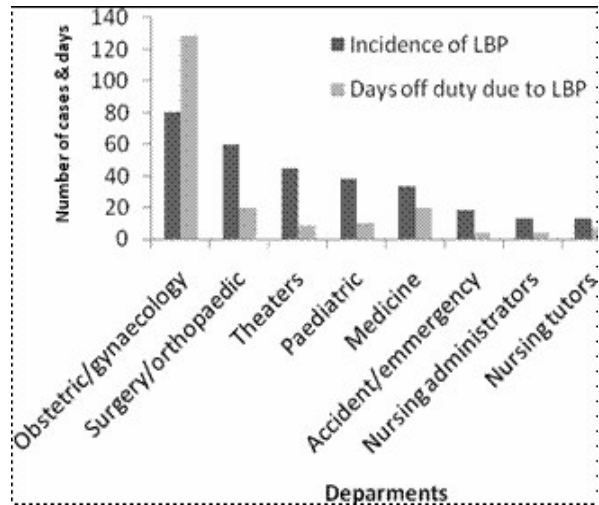
**Table 1: Associated factors and LBP (Chi square [X<sup>2</sup>])**

Variables	df	X <sup>2</sup> -value	p-value
Gender and prevalence of LBP	1	8.958	0.003*
Activities(cause) and prevalence	2	152.000	0.000*
Gender and severity of LBP	2	33.935	0.000*
Back care hygiene and prevalence	1	125.500	0.000*
Gender and off duty due to LBP	1	24.7130	0.000*
Gender and management of LBP	2	19.235	0.001*

P<0.05 \* significant

Out of the reported LBP cases, those working in the Obstetric and Gynecology (O & G) department including labour room/ward showed high prevalence of LBP 80 (26.67%) as indicated in Figure 1. The duration of LBP was acute (less than 2 weeks in 140 (46.67%), sub-acute (lasting between 2 weeks to 3 months) in 58 (19.33%) and chronic lasting more than 3 months in 102 (34%). Prevalence of LBP increased with age; age group < 35, 36-45 and > 46 reported LBP of 19 (6.3%), 81 (27%) and 200 (66.7%) respectively.

**Figure 1: Departmental to departmental incidence of LBP and days off duty**



**Causes of LBP**

200 (66.67%) of the LBP cases believed that their LBP was related to their work (occupation) while 40 (13.33%) and 60 (20.00%) associated their back pain with domestic and previous trauma respectively. There was significant association between activities (causative factors) and incident of LBP at p< 0.05.

**Back care ergonomics**

All respondents (100%) with no LBP had previous knowledge of back care hygiene. 80 (26.67%) of nurses with LBP had knowledge of back care hygiene while 220 (73.33%) LBP respondents had no knowledge of back care hygiene. Table 1 showed significant association between knowledge of back care ergonomics and incident of LBP.

**Severity of LBP**

One hundred and thirty 130(43.34%) nurses indicated that their pain was mild and that it did not disturb their daily activities; 116 (38.66%) reported that it was moderate and 54(18%) was severe. Out of the 116 nurses with moderate LBP, 53 reported that it prevented from going to work while the remaining 63 only reported restriction in daily activities. 54 (18%) thought it was severe, preventing

them from going to work. Table 1 showed significant association between gender and severity of LBP.

### Day's off-duty due to LBP

About 107 (35.67%) who reported LBP had been off-duty in one time or the other for the past 12 months. Out of this, 92 (85.98%) were females while 15 (14.02%) were males. Female nurses reported 164 (81.19%) days while males reported 38 (18.81%) days off-duty.

There was a significant association between sex and days off-duty at  $P < 0.05$ . A total of 202 off-duty days was reported by those with LBP, The highest number of off duty days (129 days [63.86%]) was from Obstetrics and Gynecology department including Labour wards, followed by Medicine and Surgical Unit with 20 days (9.90%) each. The least off duty days (4 days [1.98%]) each was reported from Accident and emergency Unit and among nursing administrators. Two hundred and two days off-duty was reported by 107 nurses resulting to an average of 1.89 days (approximately 2 days) within 2 months. The total working days for all respondents were 148,920 days (408 X 365) and total off-duty days were 202 (0.14%).

### Management of LBP

Of those with LBP, 125 (41.67%) sought relief from medical consultation prescriptions, 81 (27%) sought relief by physiotherapy, while the remaining 94 (31.33%) sought relief by self medication.

### Discussion

The 12 month prevalence of LBP in this study was 73.53%, this is considered high and was in line with that reported by Maul et al<sup>13</sup>. They reported high annual prevalence varying from 73% to 76% among nurses employed by a large university hospital in Switzerland. The present study also concurs with the findings of Knibbe and Friele<sup>14</sup> and Smedley et al<sup>15</sup>. They reported slightly higher prevalence varying between 56% and 90% among nurses. The increase in prevalence of LBP with age in the present study may not be unconnected to the report of study carried out by Charlotte and Stuart<sup>16</sup> that the susceptibility of chronic diseases increases with age; this increase is a reflection of both physiological changes and cumulative environmental (occupation) and genetic risk factor exposure.

Despite this high prevalence, the etiology and nature of LBP are not yet well understood. Many

studies have reported a strong association between musculoskeletal disorders and work related factors<sup>12, 17-19</sup> and work pressure<sup>20</sup>. This was also found among nurses<sup>21</sup>. In the present study, 66.67% related their LBP to their occupational hazard.

Poor working and incorrect lifting postures has been implicated as causative factors in LBP<sup>22-27</sup>. In the present study, all nurses without LBP (108) had previous knowledge of back hygiene while 220 (77.33%) with LBP had no knowledge of back care hygiene. Significant association ( $P < 0.05$ ) was found between back care hygiene and incident of LBP among nurses as shown in table 2.

There was a significant association ( $P < 0.05$ ) between sex and severity of LBP. Males reported 16.67%, 5.33% and 10% for mild, moderate and severe LBP, while females reported 26.67%, 33.33 and 8% for mild, moderate and severe LBP respectively. Generally, 64.86% of the total male reported LBP while 78.46% of the total female reported LBP. Significant association was found between gender and prevalence of LBP. The reason for female preponderance in this study is unclear but it may be related to the anatomical, physiological and structural difference between males and females; also mechanical disadvantage, sprain and strain, are more common in females than males<sup>28,30</sup>. Back muscle weakness, sprain and strain (low back sprain), has been implicated as a causative factor of LBP<sup>2,27,31</sup>.

In the present study, nurses generally lost about 202 working days in 12 months (408 X 365 days) amounting to about 0.14%. This is considered very low. LBP has been identified as one of the main causes of loss of hours and days among the working class citizens. Frost and Mofett<sup>32</sup> reported that the time off work due to LBP in England in 1989 increased by 40% in comparison to 5.6% for other complaints. The survey showed by Triolo<sup>12</sup> indicated that nurses lost 750,000 days a year as a result of back pain. The reasons for low loss of working hours and days in the present study might not be unconnected to fear of premature retirement or termination of appointment by employers on the pretence of ill-health. Also, nurses and employers often reject excused duty (complete rest) due to severe shortage of staff coupled with high turn out of patients.

There was a significant gender association with off duty days at  $P < 0.05$ , this is due to the fact that females reported high incidence of LBP.

In the present study, obstetric and gynecology including labour ward reported the highest incidence of LBP 80 (26.67%) while nursing administrators and tutors reported the least of 13 (4.33%) each. The highest in O & G department might be related to the fact that only female nurses (midwives) work in O & G department and prevalence is more in females. It might also be related to work pressure in O & G including labour ward in MMSH.

Management of LBP with physiotherapy, chemotherapy and surgery has been well established<sup>25,33</sup>. There was no sex difference in consultation and management of LBP, but there was a significant association between severity of LBP and type of management adopted by nurses at  $P < 0.05$ .

### Conclusion

The prevalence and cause of LBP in MMSH, Kano, Nigeria is similar to those reported within and outside Nigeria. The study concluded, therefore that LBP is a widespread disease affecting nurses but not a major cause of sickness absence in the workplace. Poor knowledge of back care ergonomics and unavailability of lifting equipment are major predisposing factors to LBP among nurses (occupation hazard oriented).

### Recommendation

- (1) Refresher course on back care ergonomics and patient transfer should be organized for nurses on regular basis.
- (2) Hospitals should be well equipped with all necessary lifting equipment. All these might go a long way in reducing the high rate of LBP among nurses.

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