INCARCERATION AND STRANGULATION OF EXTERNAL HERNIAS

THE PATTERN OF INCARCERATION AND STRANGULATION OF EXTERNAL HERNIAS AS SEEN AT KENYATTA NATIONAL HOSPITAL OVER THE PERIOD JANUARY 1994 – DECEMBER 1999.

BY

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DECLARATION

THIS DISSERTATION IS MY ORIGINAL WORK AND HAS NOT BEEN
PRESENTED FOR A DEGREE IN ANY OTHER UNIVERSITY.

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LIST OF ABBREVIATIONS.

N	no, number
SOPC	Surgical Out Patient Clinic
Pt	Patient
Fig	Figure
%	Percentage
CVP	Central Venous Pressure
NG	Nasogastric
Co.	Conservative
IV	Intravenous
Syn	Synonymous

ACKNOWLEDGEMENTS.

ABSTRACT.

This is a retrospective study of one hundred and eighty eight patients with incarcerated/strangulated external hernia who were admitted at the Kenyatta National Hospital, Nairobi between January 1994 and December 1999.

The commonest types of incarcerated/strangulated external hernias are inguinal 63.4%, umbilical 19%, epigastric 5% and femoral hernia 0.7%.

An average 31 patients per year were admitted with incarcerated/strangulated external hernias (incidence).

Incarceration/strangulation of external hernias predominantly occurs in males (male:female ratio of 12:1) and mostly occur on the right side (in this study right 68.7% vs left 24.6%).

Some external hernia incarcerate/strangulate more easily than others. In this study, hernias with the highest incarceration rate include femoral 33.3%, inguinals 13.33%, umbilical 7.06% and epigatric 4.26%.

The mean age of patients in this study was 2 years and the commonest age group was 21-50 years (48.4%). The commonest presenting features were local hernial site pain (98.9%) and local hernial swelling (97.9%).

Age (the very young and very old) and co-morbid condition increased morbidity and mortality. In this study, 3 of the 4 patients who died were aged10 weeks and had gastro-enteritis.

Duration of hernia for less than a year increased the risk or chances of incarceration/strangulation. In this study, 76% of the patients had hernia for less than one year.

The commonest complication in this study included testicular edema/hematoma (3.7%) and wound sepsis (2.1%).

The most prevalent associated factors include: chronic cough 12.2%, straining at micturation 4.8% and straining at defaecation 3.72%.

Of 188 patients admitted, 159 (84.6%) patients had emergency surgery and 29 (15%) conservative management. In the latter group in 8 patients their hernia reduced spontaneous and in 21 patients, the hernia was reduced under sedation (pethidine/valium) especially in children.

Thus it is recommended that early repair of hernia is performed in all hernias and especially in the very young, very elderly, patients with short history of hernia and certain types of hernia (inguinal hernia in children and femoral hernias in adults).

INTRODUCTION AND LITERATURE REVIEW

STRANGULATED EXTERNAL HERNIAS.

Introduction/Definition

Strangulated external hernias are those in which the blood supply to the contained par has been impeded, or cut off usually by a constriction, or band intrinsic to the hernia itself.

Incarcerated (syn obstructed) hernia is an irreducible hernia but the blood supply to the contained part is intact (1)

It has been reported that incarcerated/strangulated hernia are responsible for 77% of bowel obstruction in Northern Uganda and 65% in Northern Nigeria (2,3).

In Kenya, a study (involving 139 patients in a provincial hospital with intestinal obstruction) found sigmoid volvulus and external hernia to be the two important cause (4). This contrasts the picture in countries with comprehensive health services (read western countries) where strangulated hernia now accounts for 15-20% of bowel obstruction (5,6,7).

The true incidence of strangulating hernias is difficult to establish but ranges from 5-15 per 100,000 populations (1).

Although strangulation may occur at any age it is characteristically a complication of adults above the age of 40 years: incidence then rises steeply, reaching a maximum between 70 and 80 years of age. In the study by Andrew (1987) (8) found that among patients who arrived within 24 hours, the mortality rate was 1.4% but those who came after 48 hours were 21%. This is mainly due to two main factors poor general condition (due to dehydration, electrolyte imbalance and metabolic derangement) and the stress of surgery, infection and release of toxic substance from a necrotic/gangreneous bowel.

Inguinal hernias predominate in most series with male:female ratio 8-10:1; femoral hernias occur next in a 1:4 male:female ratio; then umbilical hernia male:female ratio 1:1 and incisional hernia male:female ratio 1:3 (1).

Most common strangulated hernias in children are inguinal (> 95%) (1).

Groin hernias are considerably more common on the right side than on the left side in both men and women. The frequency of strangulation however, is related to the distribution of hernia in general rather than to any sex-linked factors (1).

Although strangulation occasional occurs with the first descent of the hernia, it is far more often associated with old longstanding and frequently incarcerated/hernia (9).

Etiology

The true explanation as to why hernia of all forms may undergo strangulation is unknown (1). Large series (10,11) done on strangulation have concluded that pathology intrinsic to the hernia itself or its content rarely acts alone in the causation of strangulation. Indeed, less than 1% of hernias have a band or other abnormality that can clearly be implicated as causing strangulation. RE Condon (12) noted that "the essential substrate that permits the development of a strangulating hernia is the presence of a small opening in the abdominal wall with rigid margins. It is not surprising therefore, that femoral and umbilical hernias are more commonly associated with strangulation than other varieties of hernia.

In femoral hernia, the neck of the sac is responsible for 60% of the obstruction and the inguinal ligament – 33%. For inguinal hernia, the neck of the sac is responsible for 80% of obstruction and external ring for 20% (1).

Factors that initiate strangulation in a hernia that has been present chronically for many years is poorly understood. Perhaps it is through intestinal oedema, or a large bolus passing into the contained intestine, that the rigid confines of the hernia itself can now act as a true obstructing mechanism.

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<u>Inguinal hernia (see figure I and II)</u>

- An indirect inguinal hernia passes through the internal ring, along the canal and the if large enough emerges through the external ring and descends into the scrotum

- A direct inguinal hernia pushes its way through an attenuated and weakened poster wall of inguinal canal medial to the origin of inferior epigastric artery (Hasselba triangle)

<u>Anatomy of inguinal canal (see figure 1)</u>

This is a musculo-aponeurotic defect (passage) 4cm long, above and parallel to t inguinal ligament extending from the deep to superficial rings.   Transmits the v deferens in the male and round ligament in the female.

Anteriorly. the skin. superficial fascia and external oblique aponeurosis cover the f length of the canal: the internal oblique covers its lateral one third.   Posteriorly. t conjoint tendon (representing the fused common insertion of the internal oblique a transverses abdominis muscles into pubic crest) forms the posterior wall of the car medially. the transversalis fascia lies laterally.   Above the lowest fibres of the interr oblique and below – lies the inguinal ligament.

The internal (deep) ring lies half an inch above the mid-inguinal point in fasc transversalis lateral to inferior epigastric vessels. The external ring lies supero-medial the pubic tubercle in external oblique oponeurosis. Inguinal hernia is subdivided in

indirect and direct types: in indirect type, the hernias pass through the internal ring, inguinal canal, external ring and into scrotum. In direct type, the hernia passes through Hassel-bach triangle through tranversalis fascia medial to the inferior epigastric vessels.

Indirect hernias may be congenital due to persistence of the process vaginalis or acquired arising later in life. Direct hernias are always acquired. Sixty percent of inguinal hernia occur on the right side, 20% on the left and 20% are bilateral (13).

INGUINAL CANAL
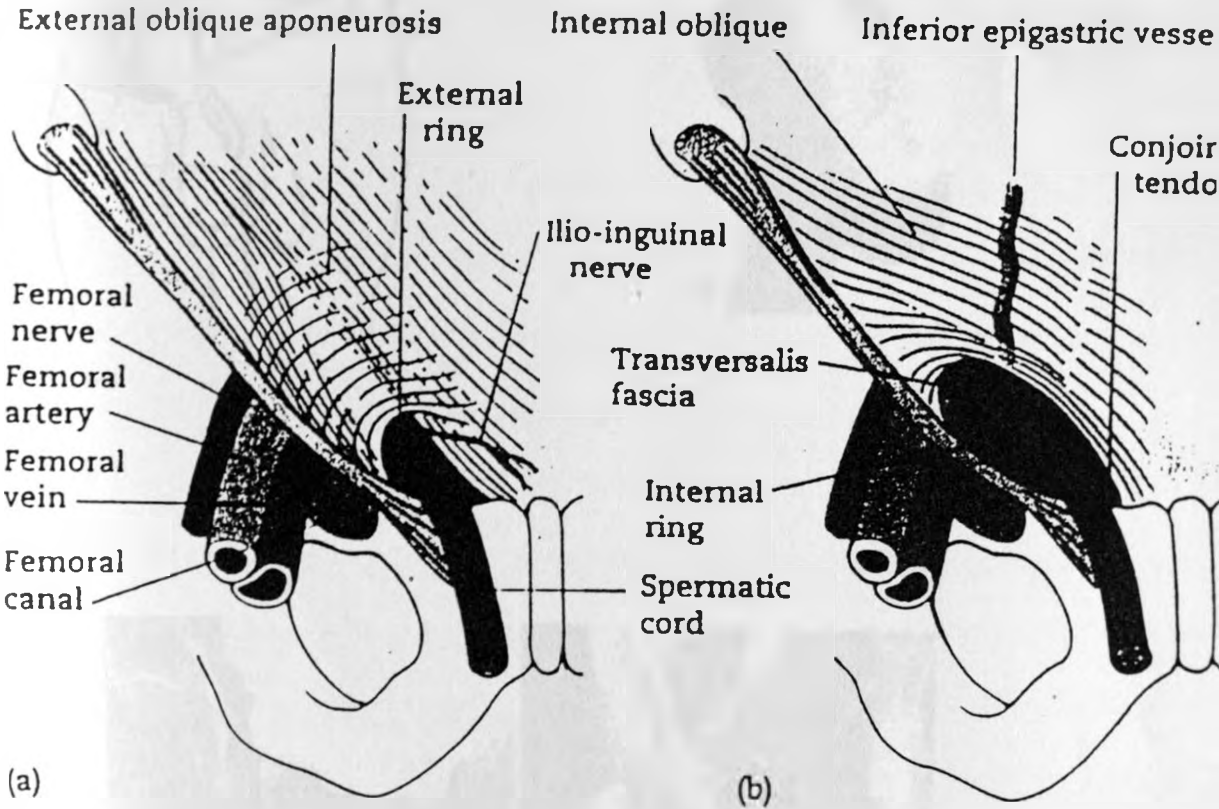
Figure 1: Anatomy of the inguinal canal:

a) With the external oblique aponeurosis intact

b) Aponeurosis laid open

(Source: "Lectures in general surgery, 9th edition by Harold Ellis et al).
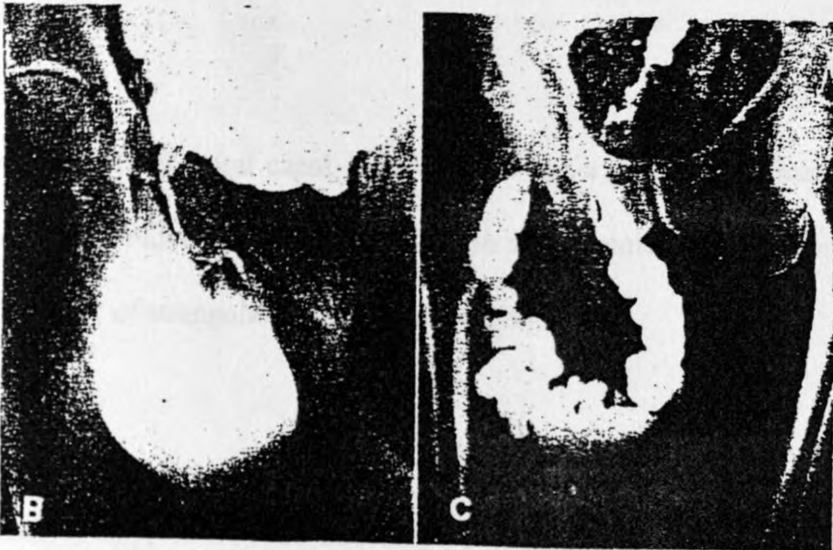
Figure 2: A) Giant inguinal hernia with radiograms showing (B) the stomach and (C) the large intestines as the contents of the sacs

(Source: Companion to surgery in Africa, 1st edition by Dr. D.P. Burkitt et al)

Femoral hernia (see figures 3 and 4)

A femoral hernia passes through femoral canal. This is the most medial compartment of the femoral sheath extending from the femoral ring to the saphenous opening.

The boundaries of the femoral canal are:

Anteriorly – the inguinal ligament. medially. the sharp edge of the lucunar part of the inguinal ligament (Gimbernat's ligament). laterally, the femoral vein and posteriorly. the pectineal ligament (of Astley Cooper), which is the thickened periosteum along the superior pubic ramus. The canal contains a plug of fat and a lymph node.

Femoral hernia occurs more commonly in females than in the males because of the wider female pelvis.

The neck of the femoral canal is narrow and has a particularly sharp medial border for this reasons. irreducibility and strangulation are extremely common in this type of hernia. Thus the risk of strangulation is high (30-40%) (14)

Omphalocoele

At about tenth week of intra-uterine gestation. the gut normally returns into an enlarged abdominal cavity (following the second rotation of the midgut loop). Failure of all or part of the midgut to return to the coelum results in omphacoele major or omphalocoele minor respectively. This swelling may consist of a single loop of bowel or it may contain most of the intestines. The covering of the hernia sac is the amniotic epithelium of the

umbilical cord. Congenital hernias at the umbilicus represent failure of closure of the abdominal wall due to persistence of the exocoelem.

Omphalocoele is more common in full-term babies but is associated with other serious congenital abnormalities in 60% of cases (e.g. anorectal anomalies, cardiac anomalies among other congenital abnormalities) (15). Thus much of the morbidity and mortality of omphaloecele is related to severity of these defects rather than abdominal wall defect itself.

The incidence of abdominal wall defects including small and large amphalocoeles, intact or ruptured and gastroschisis is probably between 1:3000-1:6000 live births (16,17).

FEMORAL CANAL

Anterior superior iliac spine

Lateral cutaneous nerve of thigh

Inguinal ligament

Fascia transversalis

External ring with emerging spermatic cord

Iliacus

Femoral nerve

Femoral artery

Psoas tendon

Femoral vein

Fascia iliaca

Pectineus

Femoral canal

Lacunar part of inguinal ligament
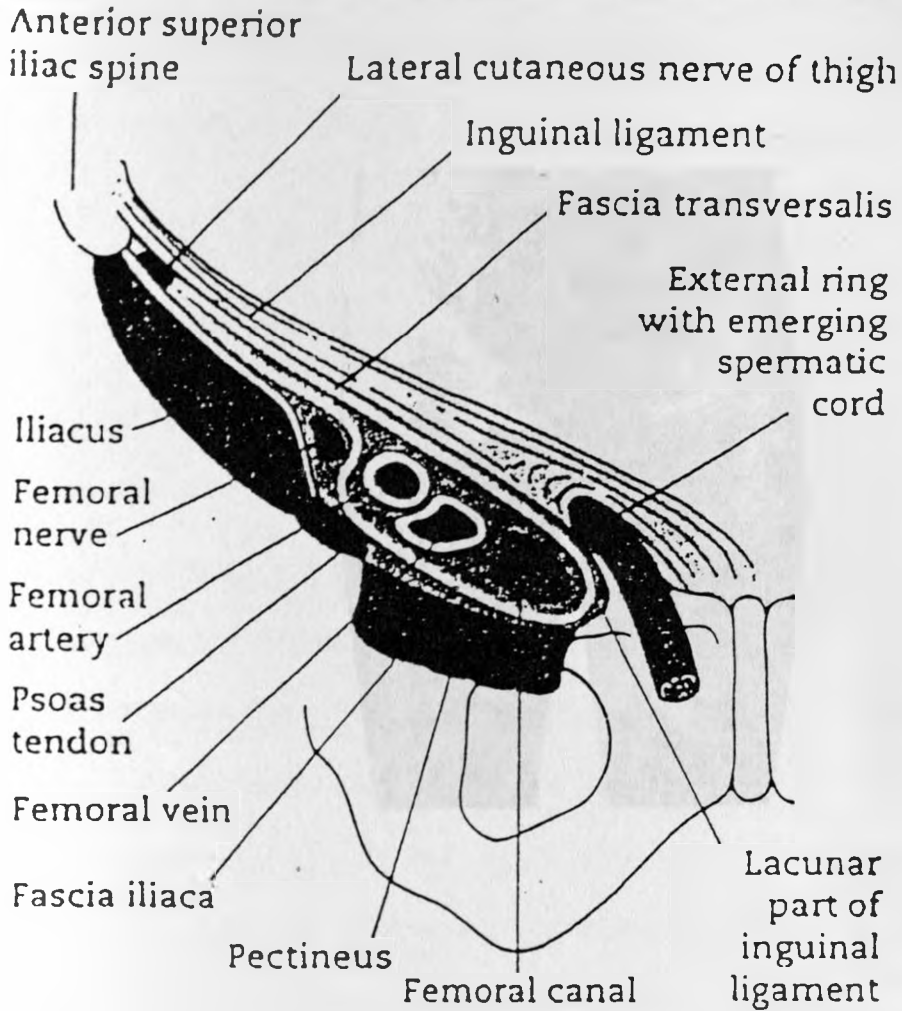
Figure 3:   The anatomy of the femoral canal and it's surrounds to show the relationships of a femoral hernia

(Source: Lecture notes in general surgery 9th edition by Harold Ellis et al)

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... of the unroofed and the wound heals by granulation and ... ... nical ring of the abdominal wall. Failure of fusion allows a ... ... nally at the superior margin of the ring. Infantile hernia is ... ... always covered with skin.

... ... of ... ... the ratio 2:1 and 90% of ... ... hernia rarely enlarges ... ... Incarceration and ...

... ... the right side above as ... ... of the abdominal wall can ...
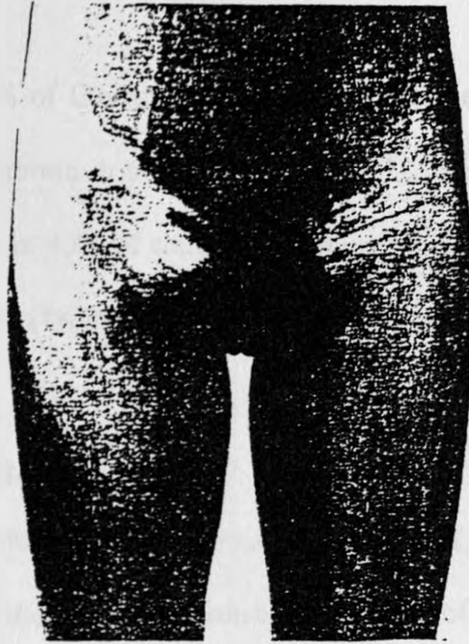
Figure 4: Femoral hernia: Note the swelling lies below the inguinal crease, a key point in differentiating it from inguinal hernia. There is also a small left femoral hernia.

(Source: Companion to surgery in Africa, first edition by D.P. Burkitt et al)

Umbilical hernia of infants and childhood (see figure 4)

At birth, following division of the umbilical cord the stump heals by granulation and scarring to fuse with the umbilical ring of the abdominal wall. Failure of fusion allows a peritoneal sac to protrude, usually at the superior margin of the ring. Infantile hernia as opposed to congenital type is always covered with skin.

The hernia is present in 10% of Caucasian infants (male:female ratio 2:1) and 90% of black infants. It is more common in premature babies (17). The hernia rarely enlarges over time and will disappear in 93% of children by the age of 2 years. Incarceration and strangulation is extremely rare (18.19).

Adult para umbilical hernia

This is an acquired hernia which occurs following disruption of the linear alba above or much less commonly below the umbilical cicatrix. Stretching of the abdominal wall due to obesity, multiple pregnancy and ascites favour the development of this hernia. Usually occurs after the age of 35 years and male:female ratio is 1:5.

This hernia enlarges progressively and over time it becomes rounded or oval in shape with tendency to sag downwards. The neck of the sac is often remarkably narrow as compared with the size of the sac and the volume of its contents, which consists of greater omentum often accompanied by small intestine and alternately or in addition, a portion of transverse colon. In long standing cases, the sac sometimes becomes loculated due to adherence of omentum to its fundus.
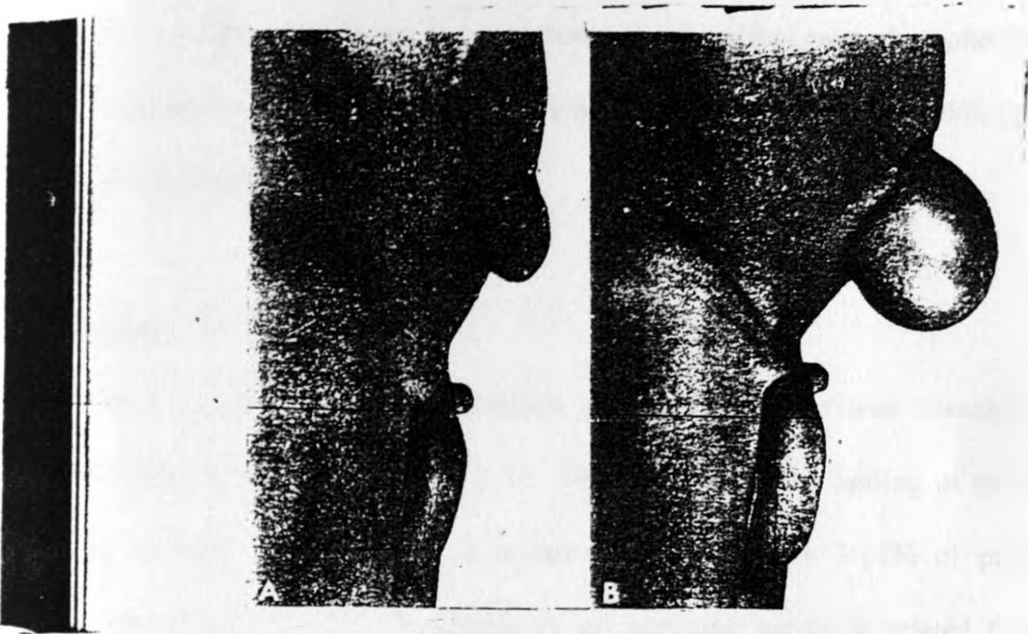
Figure 5:

A)   Infantile umbilical hernia (reduced)

B)   Umbilical hernia increasing in size with cough

(Source: Companion to surgery in Africa by D.P. Burkitt et al)

The paraumbilical hernia usually has a small neck. Incarceration and strangulation are therefore common.

Epigastric hernia

An epigastric hernia is a protrusion of preperitoneal fat through a gap in the decussating fibres of the supra-umbilical portion of the linea alba. The defect usually occurs where the linea alba is pierced by a blood vessel. A peritoneal sac may accompany fat through the defect and may contain omentum but only rarely bowel. Often more than one hernia is present. Epigastric hernia is present in 5% of individuals at autopsy; 25% of the individuals have multiple hernias (15).

Incisional hernia

Incisional hernia is defined as an abnormal protrusion of a viscus through the musculoaponeurotic layers of a surgical scar. There is a complete healing of the skin overlying the incision. Incision hernia occurr in approximately 3-13% of patients following laparatomies (20.21). The aetiology of incisional hernia is related to pre-operative and post-operative factors and complications. There is no significant difference between sexes in the incidence of incisional hernias (men 55%, women 45%) (22).

Pathology

A hernia consists of three parts viz. the parietal defects, the sac and the contents. The defect in the abdominal wall may be an abdominal wall defect or an abnormal opening of congenital, traumatic or inflammatory origin.

The pathology of strangulation consists of a triad of simple obstruction above the involved area, closed loop obstruction of the involved loop and interference with blood supply of the involved loop (23.24).

The intestine is usually obstructed (except in a Ritcher's hernia) and in addition its blood supply is constricted. At first, only the venous return is impeded. The wall of the intestine becomes congested and bright red and serous fluid is poured out into the sac. As the congestion increases, the intestine becomes purple in colour. As a result of increased intestinal pressure the strangulated loop becomes distended (see figure 6 and 7).

As venous stasis increases, the arterial supply becomes more and more impaired. Blood is extravasted under the serosa (an ecchymosis) and is effused into the lumen. The fluid in the sac becomes blood stained. The shinning serosa becomes dull and covered by a fibrous sticky exudates and the wall of the intestine becomes atonic, flabby and very triable. The latter conditions favour migration of bacteria through intestinal wall and into fluid.

Gangrene appears first at the rings of constriction which become deeply furrowed and grey in colour and then it appears in the antimesenteric border and spread upwards, the colour varying from black to green according to the decomposition of blood in the subserosa. The mesentry involved by strangulation also becomes gangrenous. If the strangulation is unrelieved, perforation of the wall of the intestine occurs; either on the
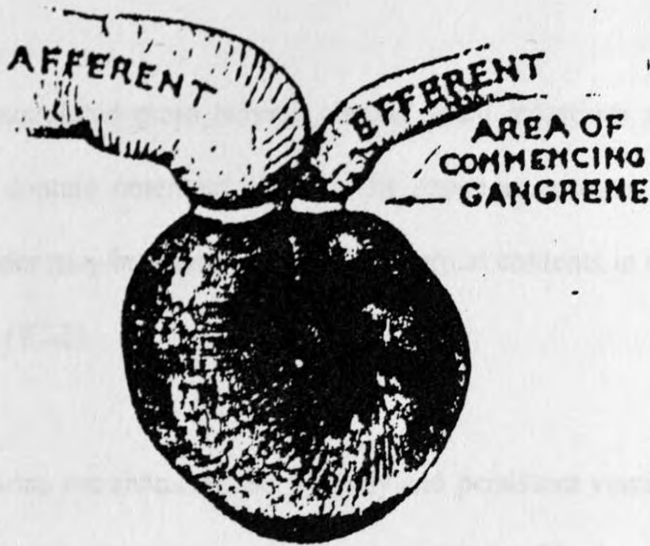
Figure 6: Shows gangrene commences at the area of constriction and then at the antimesenteric border.
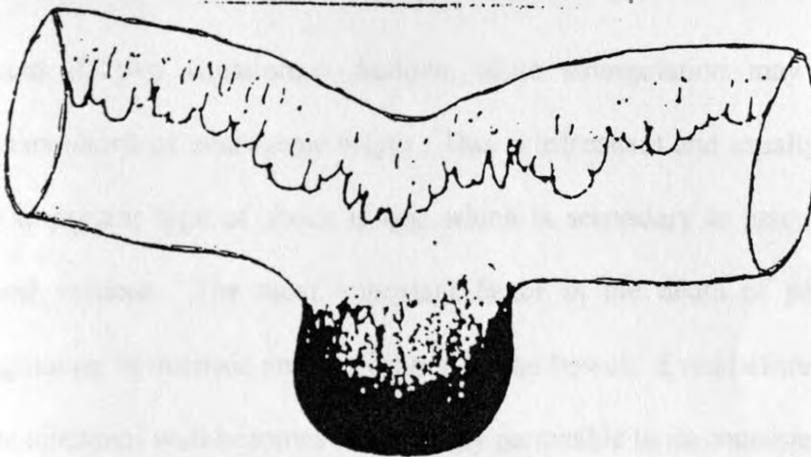
Figure 7: Shows gangrenous Ritcher's hernia from a case of femoral hernia

(Source: Bailey and Love's – short practice of surgery, 22nd edition)

convexity of the loop or at the seat of constriction. Peritonitis spreads from the sac to the peritoneal cavity.

About 70-80% of strangulated groin hernias contain small intestines as their primary component and 15% contain omentum alone. The appendix, cecum, female internal genital organ and bladder may be found as part of the hernial contents in the remainder of patients in large series (9,22).

High intestinal occlusions are characterized by early and persistent vomiting, with rapid depletion of the fluid and electrolyte reserve. Associated with the dehydration and hypochloremia are severe metabolic disturbances, including alkalosis from loss of gastric acid, oliguria and nitrogen retention.

Shock can occur in two situations. Sudden, acute strangulation may precipitate immediate primary shock of neurogenic origin. This is infrequent and usually is of brief duration. The important type of shock is one which is secondary to loss of effective circulating blood volume. The most important factor in the death of patients with intestinal strangulation is necrosis and perforation of the bowel. Even before viability is entirely lost, the intestinal wall becomes increasingly permeable to its contained bacteria.

Clinical presentation

Ten to twenty percent of groin hernias present with strangulation as the first manifestation of any hernia. This is especially true of femoral hernias; in one series, 42% of femoral hernias had strangulation as the presenting feature (25). Most hernias (60%-75%) however, have been present for longer than a year. Delay in presentation and diagnosis is not uncommon, ranging from 1 to 8 days in some series. Incarceration of a hernia need not progress to strangulation although irreducible masses in the groin should not be ignored (10,24).

Strangulated inguinal, femoral and umbilical hernias almost always cause pain at the site of herniation (1,14). Rarely in older institutionalized, or obese patients is pain absent because strangulation of the intestine of necessity produces intestinal obstruction. crampy abdominal pains, vomiting and constipation may occur. Persistent, severe vomiting is occasionally present.

On examination, the hernia is tense, extremely tender, irreducible and there is no expansive impulse on coughing. Signs of inflammation (fever, tachycardia, hypotension and prostation) are late features and are indicative of delay. Prospective studies, however, have failed to reveal any correlation between the severity of clinical findings and the prediction of viability of the contained intestine (12). Distension, hypoactive bowel sounds, oliguria and dehydration are further pointers to intestinal obstruction and the sequestration of intravascular volume in the strangulating segment of intestine.

Partial strangulation of the intestinal wall (Ritchers hernia, figure 8) occurs in 2%-10% of groin hernias and may result in serious consequences despite apparently successful reduction of the hernia (26,27). This is due to a delay in diagnosis and operation, as the patient opens up bowels and may not vomit. Thus the need to operate on all incarcerated and strangulated hernias within 24 hours of the reduction (1).

Reduction en masse (figure 9), in which external evidence of the hernia disappears but the peritoneal sac continues to strangulate the enclosed viscous, occurs occasionally (0.5%) (28). Similarly, reduction en W., in which only part of the contained intestine is reduced while the remainder continues to strangulate is also reported (29).

Management of strangulated hernias

The treatment of strangulated hernia is emergency surgery. The time element is of paramount importance in the successful management of strangulated hernia. Few surgical conditions display a more direct parallel between the duration of the symptom and mortality (8,9,10). The only contra-indication to operation is impairment of the general heath of sufficient severity to render such as operation unduly harzadous.

A hernia, once strangulated demands repair before another episode occurs. Little is accomplished beyond postponing the operation for a matter of days if hernia is reduced.

Richter's hernia

Knuckle of bowel inside hernial sac

Peritoneum

Bowel

(a)

Reduction *en masse*

Hernial sac

Peritoneum

Bowel

Reduction hernial sac reduced as well

Obstruction still present
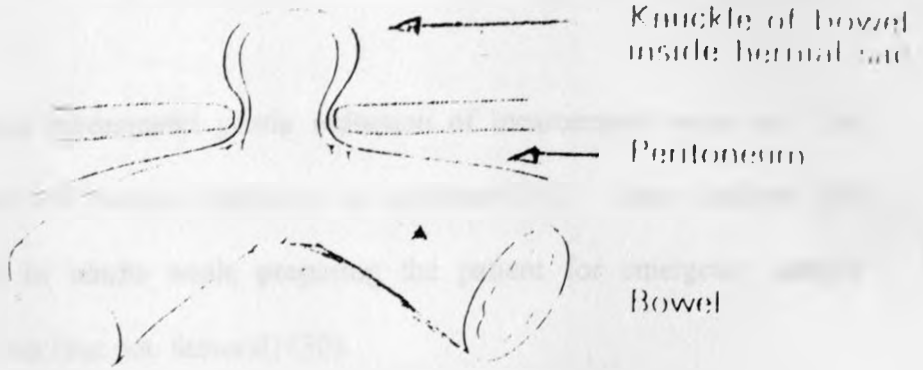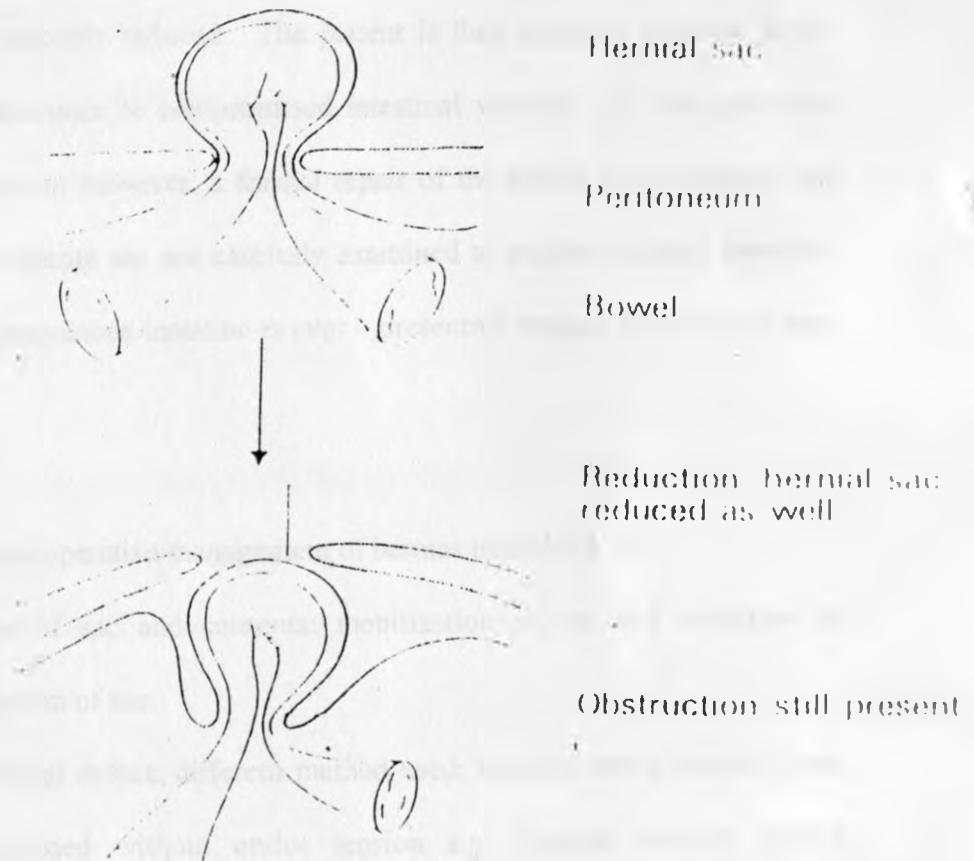
Hazards of taxis include rupture of the bowel, reduction of non-viable intestine, laceration of the sac and incomplete release of the constriction (reduction en masse) (4).

However, some authors recommend gentle reduction of incarcerated hernia as first option in management of hernia especially in children (30). Some authors also recommend reduction in adults while preparing the patient for emergency surgery especially inguinal hernia (but not femoral) (30).

This is usually accomplished with patient in Trendelburg position (see figure 8) and under light sedation (30). The fundus of the sac is gently squeezed and manipulated until the hernia has become palpably reduced. The patient is then carefully watched in the hospital for signs of recurrence or compromised intestinal viability. At the opportune time, of the same admission however, a formal repair of the hernia is undertaken, and then the contents of the hernia sac are carefully examined to exclude organic intestinal disease. Reduction of gangrenous intestine is ever – presenting danger, occurring in upto 1% of large series (5).

The main principles in the operative management of hernias include (31)

1.   Identification of sac and contents: mobilization of sac and reduction of contents: ligation of sac.

2.   Repair of fascial defect; different method used: healthy, strong fascial tissue must be apposed without undue tension e.g. inguinal hernias: fascial transversalis to inguinal ligament.
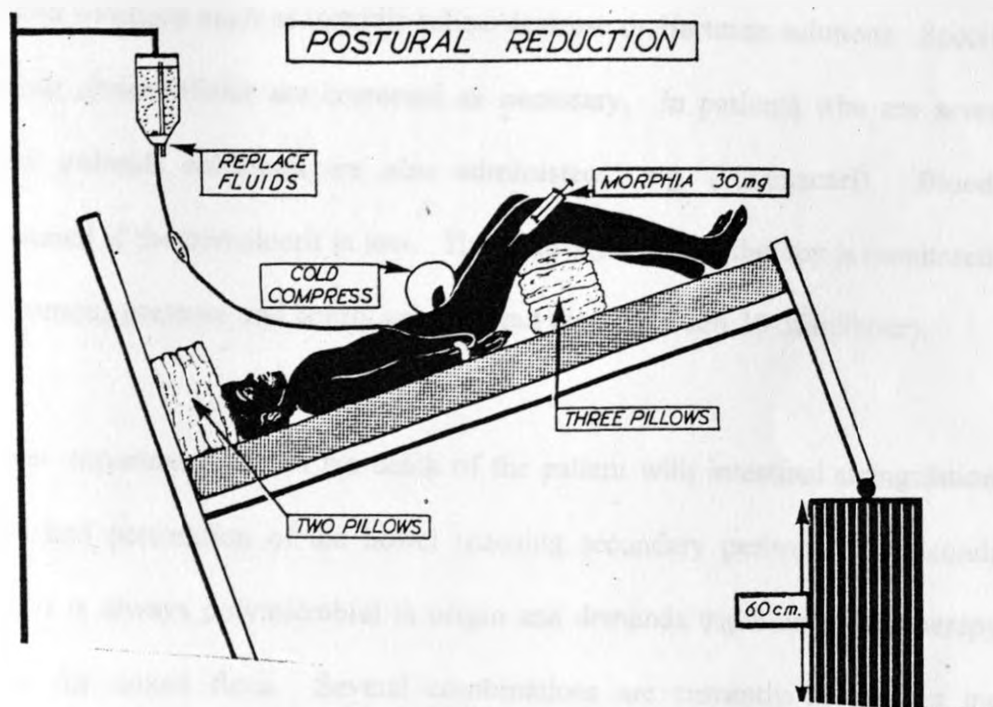
Figure 10: Diagram indicating the regimen of posturial treatment of strangulated indirect inguinal hernia. This method is only performed if the strangulation time is under 24 hours (and preparation is underway for emergency surgery)

(Source: Companion to surgery in Africa by D.P. Burkitt et al – first edition)

Adequate pre-operative preparation of the patient is very important as it reduces both morbidity and mortality. Supportive measures include nasogastric suction, intravenous fluid to correct the hypovolemia and electrolyte deficiencies, monitoring and prompt and adequate pain relief. Volume expansion is carried out with crystalloid solutions such as isotonic saline/dextrose or Hartman solutions. Specified electrolyte abnormalities are corrected as necessary. In patients who are severely shocked, colloids solutions are also administered e.g. (Haemacael). Blood is administered if the hematocrit is low. The intravenous fluid therapy is monitored by central venous pressure and hourly urine output (kept between 30-50ml/hour).

The most important factor in the death of the patient with intestinal strangulation is necrosis and perforation of the bowel (causing secondary peritonitis). Secondary peritonitis is always polymicrobial in origin and demands triple antibiotic therapy – essential for mixed flora. Several combinations are currently in use but most favoured is – aminoglycoside/third generation cephalosporins/metronidazole regimen which is maintained for 10 days. If continued beyond 2 weeks, then combination of antibiotics carries a significant risk of invasive fungal infection (22).

In evaluating the merits of the type of anaesthesia used, mortality is the bottom line. The method of anaesthesia and the choice of the anaesthetic agent used depend on the general condition of the patient following strangulation and any other medical condition and its complication (14,32).

Local anaesthesia is indicated in patients who cannot stand general anaesthesia e.g. patients who are dehydrated and have severe metabolic and electrolyte imbalances. Local anaesthesia is cheaper and duration taken is relatively shorter.

Spinal anaesthesia can also be used and is useful especially in patients with associated intestinal obstruction. The muscular relaxation it induces facilitates exploration and the increased intestinal tone produced tends to overcome the intestinal distension proximal to site of obstruction. Spinal anaesthesia induces hypotension and is thus not indicated to patients with severe shock and critically poor general conditions.

General anaesthesia can be used in patients who are fit for it. Long term results of hernia repair show no difference in recurrence rate between those repaired under local anaesthesia and general anaesthesia (33). For local. 0.5% lignocaine, with 1:200.000 adrenaline may be used to a maximum of 100mls for a 70kg man.

A skin weal is raised in the line of incision and the ilio-inguinal and iliohypogastric nerves blocked lateral to the inguinal canal. The subcutaneous tissues and the region of the deep ring and the emergent cord will need infiltration during operation.

A combination of short acting regional anaesthesia (Lidocaine-epidural) given prior to the incision with long acting local anaesthesia (Bupivaccine) injected while the wound is still closed can be used. This provides appropriate operative anaesthesia and post-operative analgesia in out patients (33).

Suture material use

At least 4-6 months of healing and remodeling of the aponeurosis for development of adequate hernia repair is required hence the choice of good suture materials.

The type of suture material to be used is a matter of individual choice, and many conflicting views have been expressed. Dexon, nylon, linen and silk thread and stainless steel and tantalum have all been advocated, but the results have not determined the superiority of any one method (34,35).

Surgical repair

The technique of repair for an acute hernia does not differ from elective surgery (36), with exception of prosthetic mesh, which should be placed with caution where there is gross infection, or dead bowel. If bowel resection is being considered however, the preperitoneal approach is advised. This involves a lower midline incision, or a unilateral Pfannestial incision parallel and two fingers' breath above the pubis symphysis. In both approaches, the extraperitoneal space is entered behind the rectus muscle after incising the transversalis fascia. Once the extraperitoneal space has been entered, an obstinately irreducible sac may need to be opened at its neck to reveal the contents. After close inspection, followed by the application of warm packs, viability of the intestines can be assessed if necessary, bowel resection can be performed because the peritoneal cavity is now open. Repair can be effected through the extraperitoneal space with prosthetic mesh, or through the anterior route with layered suturing (shouldice operation) or mesh (Lichtenstein operation).

Complications

i. Wound infections – especially in circumstances in which enterotomies have been made. Continued fever, hypotension and cardiovascular hamodynamic measurement indicative of intra-abdominal sepsis should prompt immediate re-exploration for further infracted intestinal loops or presence of an intra-abdominal abscess.

ii. Pulmonary complications occur in 7% of patients in large series and may result in deaths in at least 30% of these patients (36).

iii. Urinary tract complications, especially infections are not uncommon because many elderly patients make up the series and require prolonged catheter drainage. In addition, the use of regional anaesthesia may predispose the bladder complication and require the use of repeated catheterization.

iv. Other complications include local haematoma, scrotal edema/hematoma, bladder and gut injury, testicular atrophy and fecal fistula.

Prolonged morbidity and mortality

The mortality for strangulated hernias has remained essentially unchanged for the past 50 years despite modern advances in anaesthesia, surgical technique and antibiotics (37). Rather, the deaths appear to be more a function of the population studied, geographic location and delay in presentation, diagnosis and treatment. Thus death in infants and children are excessively rare (38) whereas elderly people and patients in the third world countries continue to have severe morbidity and mortality.

Furthermore, the site of strangulation is important, with mortality being less in inguinal hernias than in femoral or ventral recurrent hernias.

The cause of death is mainly related to sepsis, complicated by underlying cardiopulmonary disease. What is clear, however, is that mortalities double with strangulating gangrenous intestines (Mackenzie, 1960) (39). Thus whereas only 7% to 10% of patients have gangrenous intestines, 40%-50% of these patients can be expected to die post-operative regardless of the treatment. (1,14)

The overall mortality regardless of the state of the trapped hernial contents varies between 15% and 25% in large series.

STUDY JUSTIFICATION

- Obstructed and strangulated external hernias are common surgical emergencies worldwide and in particular in our local environment. It is associated with high morbidity and mortality. Thus every trainee surgeon must know it well.

- Obstructed and strangulated hernias is the commonest cause of intestinal obstruction in our environment. In the western world where many laporatomies are performed. adhesion predominate as a cause of intestinal obstruction.

- The true incidence of strangulated hernias in western world is approximately 5-15 per 100.000 population. No local study has ever been done to establish the incidence locally hence need to do the study.

- The overall mortality for strangulated hernias has remained high and unchanged for the past 50 years despite modern advances in anaesthesia. surgical technique and antibiotics (15%-25%) and seem to be a function of the population studied. geographical location and delay in presentation. diagnosis and treatment. This study will establish the Kenyatta National Hospital mortality rate and factors that influence it.

MAIN OBJECTIVE

The main objective was to study pattern of occurrence of incarcerated/strangulated external hernia as seen in Kenyatta National Hospital.

SPECIFIC OBJECTIVES

To study

1. The incidence of incarceration/strangulation of external hernia

2. Age and sex distribution

3. Modes of presentation

4. Management methods employed at the Kenyatta National Hospital

5. Establish immediate post-operative morbidity and mortality in relation to duration of symptoms before management.

METHODOLOGY

STUDY AREA

The study was undertaken at the Kenyatta National Hospital which is both a referral and teaching hospital.

STUDY DESIGN

This was a retrospective study and descriptive in nature of all patients with incarcerated/strangulated external hernia admitted in Kenyatta National Hospital during the study period January 1994 to December 1999.

STUDY POPULATION

All patients admitted at the Kenyatta National Hospital with a diagnosis of incarcerated/strangulated hernia during the study period (1994-1999).

STUDY MATERIAL

The patients records were used as the source of data. The material included (1) index cards in the Records Department (2) patients files in the Records Department.

INCLUSION CRITERIA

All patients with incarcerated/strangulated external hernia seen during the study period January 1994 to December 1999 in Kenyatta National Hospital.

EXCLUSION CRITERIA.

- All patients admitted before January 1994 and after December 1999.

- Patients whose files did not provide adequate relevant data as per the study

- Patients not operated or fully managed in the study period.

DATA COLLECTION

From the index cards, the names and file numbers of patients who had

incarcerated/strangulated hernia in the study period were traced and entered on the list.

Their files were then retrieved. The relevant information was extracted from each file

and entered in a serially numbered data form (see appendix I – page 65-7).

DATA ANALYSIS

Data was collected using a pretested standard questionnaire and coded before being

entered into a computer. The data was verified before analysis. Data analysis was done

using SPSS statistical package version 9.

Discrete variable frequencies and percentages were calculated and data summarized in

tables. The mean, mode, median were calculated.

For comparison (where data was categorized) chi-square statistics was used. Differences

between variables were considered significant if P value was less than 0.05.

ETHICAL CONSIDERATATION

1. The proposal was reviewed and approved by the Kenyatta National Hospital

    Ethical and Research Committee before it was carried out.

2. The clinical records were handled carefully and confidentially.

3. The principal investigator carried out diligently and as accurately as possible data

    collection, analysis and made conclusions.

LIMITATIONS.

1. These included missing files and inadequate information (where files available).

2. Time and financial constraints were limiting factors on the quality of information gathered and analysed as this is desirable.

ASSUMPTION.

The study carried out with assumption that:

1. The patient with incarcerated/strangulated external hernia had unlimited access to the health service provided at Kenyatta National Hospital.

2. Standard facility for the management of these patients were available at Kenyatta National Hospital during the study period.

RESULTS.

Algorithm of the sampling process

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┌─────────────────────────────────────────────────────┐
│        1797 patients with external hernias           │
└─────────────────────────────────────────────────────┘
         │                               │
         ▼                               ▼
┌──────────────────────┐      ┌──────────────────────┐
│ 188 patients were    │      │ 1609 patients had     │
│ admitted to KNH with │      │ uncomplicated hernia  │
│ incarcerated hernia* │      │                       │
└──────────────────────┘      └──────────────────────┘
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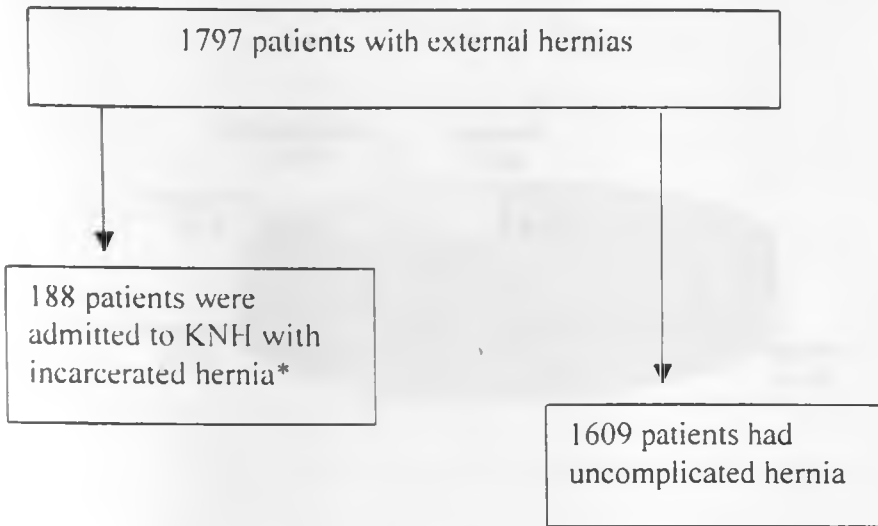
NB: Only these 188 patients could be traced in the wards and theatre records during
      the study period

Incidence: Age and sex distribution of external hernias

Table 1: Relative incidence of various types of external hernias (1994-1999).

Year	Hernias (External)					Total
	Inguinal	Umbilical	Femoral	Epigastric	Miscellaneous	
1994	142	43	1	10	28	224
1995	191	49	4	24	38	306
1996	157	46	2	12	37	254
1997	149	43	1	8	29	230
1998	200	56	1	22	39	318
1999	301	103	3	18	40	465
Total	1140	340	12	94	211	1797

Figure 11: Relative incidence of various types of eternal hernias.
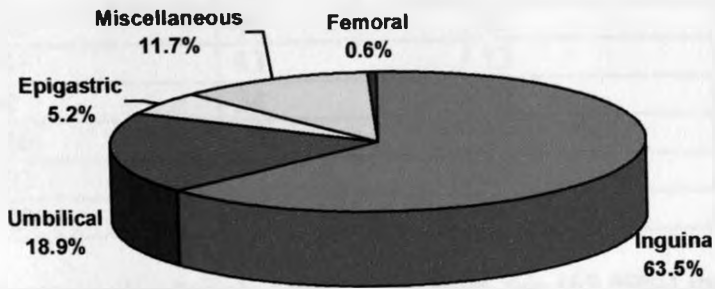
Table 1 shows the number of cases of hernia per year over the study period. The incidence of external hernia in general per annum was 299.5 patients per year.

The commonest type of external was inguinal (63.43%) and the least common is femoral hernia (0.67%). Figure 11 (pie chart) shows the relative incidence of various types of external hernias

Table 2. Annual distribution of right, left and bilateral inguinal hernia seen during the period of study 1994-1999.

Year	Hernia			Total
	Right	Left	Bilateral	
1994	95	36	11	142
1995	130	49	12	191
1996	101	43	13	157
1997	98	34	17	149
1998	146	42	12	200
1999	203	77	21	301
Total	783	281	86	1140

Most inguinal hernia predominately occur on the right side (68.69%) than left side

(24.63%). A small proportion (6.68%) do occur bilaterally.

Figure 12: Relative subtypes of inguinal hernia
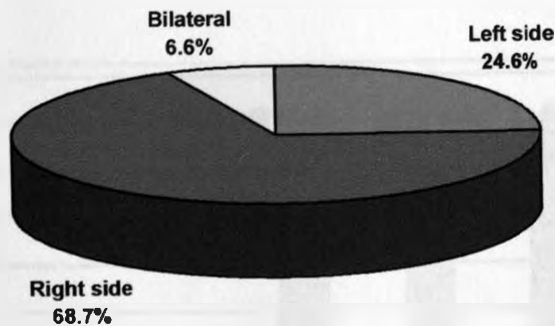
Table 4: Incarcerated/strangulated external hernia: Incidence in males and females.

Year	Male	Female	Total
1 994	24	2	26
1 995	11	3	14
1 996	19	1	20
1 997	35	1	36
1 998	39	4	43
1 999	46	3	49
Total	174	14	188

Table 4 shows the sexual distribution of the one hundred and eighty eight patients with

incarcerated/strangulated hernias. One hundred and seventy four male patient

(approximately 92.5%) and 14 females (approximately 7.5%) giving a male:female ratio

of 12:1 Note also the annual increase of total of patients with incarcerated hernias .

Figure 14: Strangulated external hernia: Incidence in males and females
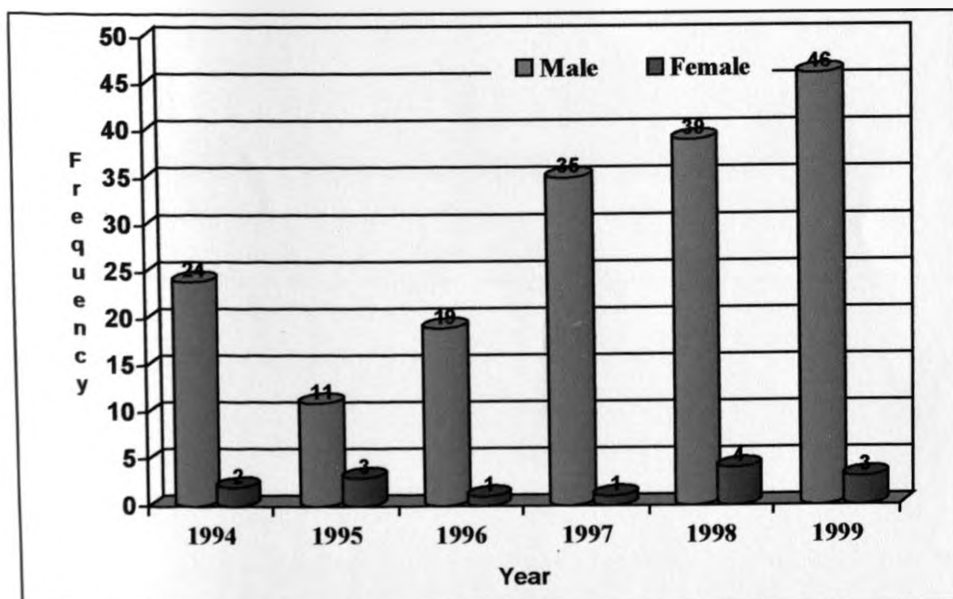
Table 5: Relative incidence and annual sexual distribution of various types of incarcerated/strangulated external hernias.

Year	Inguinal			Femoral	Umbilical	Epigastric	Miscell aneous	Totals
	Right M:F	Left M:F	Bil M:F					
1994	18:0	3:0	0:0	0:0	3:2	0:0	0:0	26
1995	8:1	2:0	0:0	0:1	2:0	0:0	0:0	14
1996	14:0	1:0	0:0	0:1	3:0	0:0	1:0	20
1997	22:0	9:0	2:0	0:1	1:1	0:0	0:0	36
1998	24:0	9:0	1:0	0:1	2:2	0:3	1:0	43
1999	30:0	6:1	1:0	0:0	8:0	1:0	2:0	49
Subtotal	116:1	30:1	4:0	0:4	19:5	1:3	4:0	174:14
Total	117	31	4					
		152		4	24	4	4	188

Table 5 shows the relative incidence and annual sexual distribution of the various types

of incarcerated/strangulated external hernias. The most common type is right inguinal

hernia and least common is epigastric and femoral hernias.

Table 6: Incarcerated rate of various types of external hernias.

Type of hernia	Inguinal	Femoral	Umbilical	Epigastric
Total number of patients seen during the study period (1799)	1140	12	340	94
Total number of patients with incarcerated/strangulated hernia seen during the study period (n)	152	4	24	4
% incarceration (n/y x 100)	13.3%	33.3%	7.1%	4.3%

Figure 15: Incarceration rate of various types of external hernia
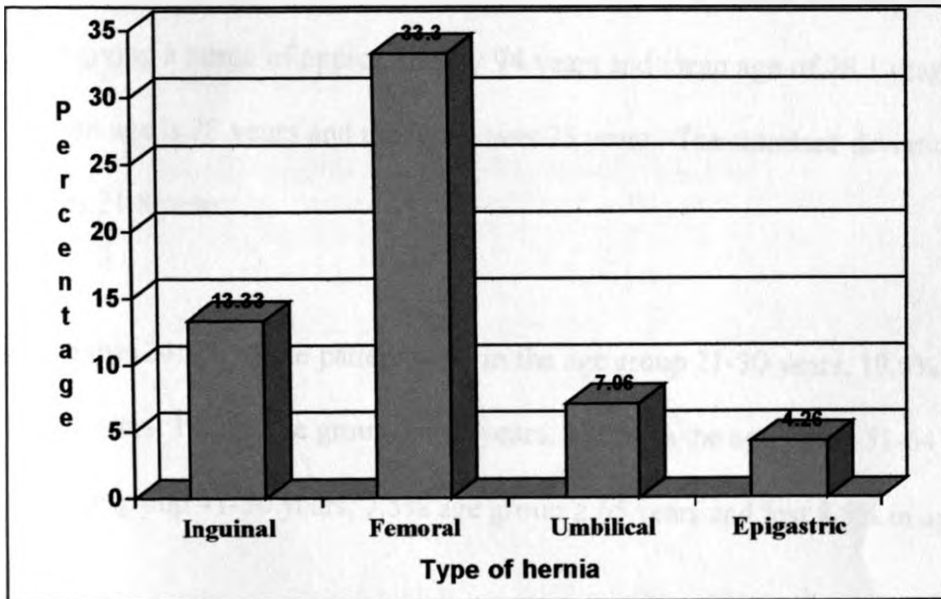
Table 7: Age and sex distribution of strangulated/incarcerated external hernia

Age in years	Male	Female	Total	Percentage
< 2	35	2	37	19.6
2-5	11	0	11	5.9
6-10	4	1	5	2.7
11-20	10	0	10	5.3
21-30	45	1	46	24.5
31-40	20	4	24	12.8
41-50	19	2	21	11.2
51-64	21	2	23	12.2
≥ 65	9	5	14	7.5
Total	174	14	188	100.0

Table 7 shows age and sex distribution of different types of incarcerated hernias. The youngest patient who developed incarcerated hernia was 6 weeks old and the oldest was 94 years giving a range of approximately 94 years and mean age of 26.1 years. Note also the median age is 28 years and the mode was 23 years. The standard deviation of the mode was 21.8 years.

Note also that 24.5% of the patient were in the age group 21-30 years. 19.6% in the age group < 2 years. 12.7% age group 31-40 years. 12.2% in the age group 51-64 years. 11.17% age group 41-50 years. 7.5% age group ≥ 65 years and last 8.5% in age group 2-10 years.

Figure 16: Age range versus number of patients in percentage (N=188)
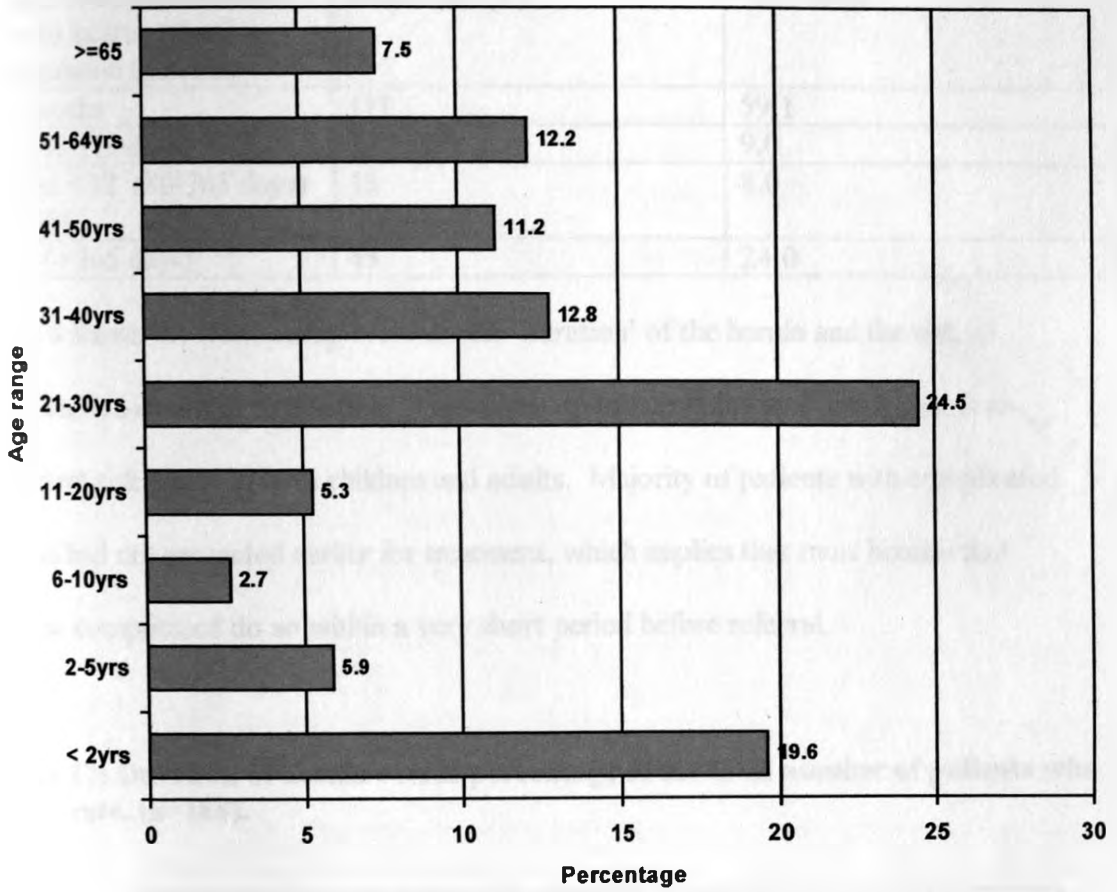
Table 8: The risk of incarceration/or strangulation versus duration of hernias

Length of history of hernia prior to incarceration/ strangulation (months)	Frequency (Y)	% of total
< 3 months	111	59.1
3-6 (90-179 days)	17	9.0
> 6 but < 12 (80-365 days) 180-364	15	8.0
> 12 (> 365 days)	45	24.0

Table 8 shows the relationship between the 'duration' of the hernia and the risk of

incarceration and/or strangulation. Thus duration of hernia for less than a year is an

important risk factor in both children and adults. Majority of patients with complicated

hernias had not presented earlier for treatment, which implies that most hernias that

become complicated do so within a very short period before referral.

Figure 17: Duration of hernia versus percentage of the total number of patients who incarcerate. (n=188).
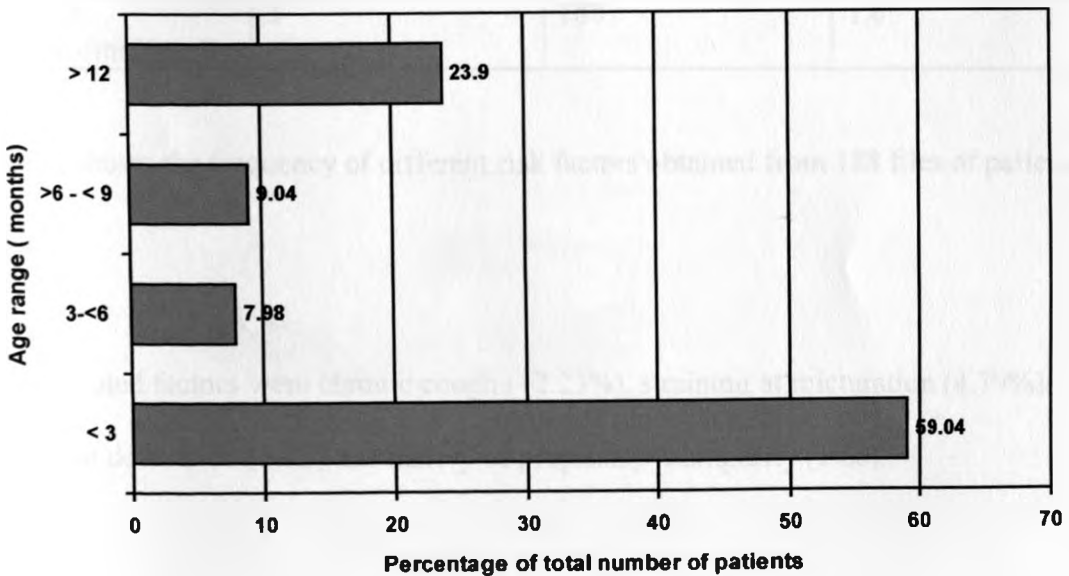
Table 9: Presentation.

Presentation	Number	Percentage
Pain locally	186	98.94
Vomiting	139	73.94
Obstipation	75	39.89
Abdominal distension	71	37.77
Local hernia swelling	184	97.87

Among the 188 patients with strangulated hernia, local hernia pain and swelling were the

most common presentation (98.9% and 97.8% respectively).

Table 10: The prevalence of different risk factors.

Risk factor	Positive history	Total number of patients	%
History of chronic cough	23	188	12.2
History of straining while micturating	9	188	4.8
History of straining at defaecation	7	188	3.7
History of chronic obesity	0	188	0.0
History of pregnancy/multiparity	3	188	1.6

Table 10 shows the frequency of different risk factors obtained from 188 files of patients

studied.

The associated factors were chronic cough (12.23%), straining at micturation (4.79%),

straining at defecation (3.75) and history of pregnancy/multiparity (1.60).

Table 11: Type of treatment used.

Type of treatment	Number	%
Conservative		
- Spontaneous reduction	8	4.3
- active reduction	21	11.1
Emergency surgery	159	84.6

Table 11 shows the mode of treatment used on 188 patients admitted with

incarcerated/strangulated hernia. One hundred and fifty nine patients had emergency

surgery and 29 had conservative treatment. In the latter group, 8 hernias reduced

spontaneously on admission and 21 patients had their hernia reduced under sedation

(using pethidine valium). They were observed for any sign of peritonitis and discharged

after two days.

Of the 29 patients, 10 patients were later operated on (hernia repair) electively and no

patient required emergency surgery during acute admission for gangrene.

Figure 18: Mode of treatment
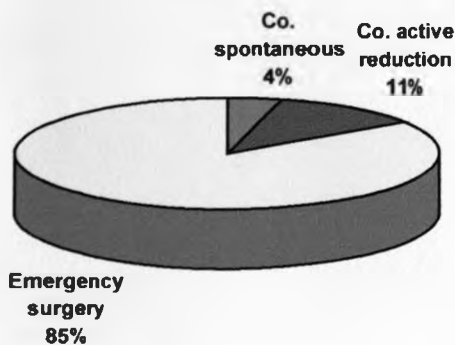
NB: Co=conservative, redu=reduction

Complications

Table 12: Outcome of incarceration/strangulation

Complication	Number	%
Wound infection	4	2.1
Testicular edema/hematoma	7	3.7
Gut injury	1	0.5
Loss of libido	1	0.5
Testicular atrophy	1	0.5
Mesenteric hematoma	1	0.5

Seven patients (3.7%) had testicular edema or hematoma. Four patients (2.1%) had

wound infection. One patient (0.5%) had gut injury, another had mesenteric hematoma,

while another had loss of libido.

Table 13: Hospital stay (in days)

Number of days	Patients managed conservatively patient days	Patient underwent emergency surgery	
		Viable gut	Gang gut
1	5	5	0
2	22	68	2
3	27	75	4
4	8	100	3
5	5	40	5
6	6	48	4
7	0	49	3
8	0	24	3
9	0	27	0
10	0	10	1
11	0	22	2
12	0	12	0
13	0	0	1
14	0	28	0
15	0	0	2
16	0	0	0
17	0	17	0
18	0	36	2
Average stay in hospital	73/29=2.5	561/127=3.7	233/32=7.3

The average hospital stay for all 188 patients is 4.6 days. Generally speaking patients who were operated on stayed longer (5.0 days) than those managed conservatively (2.5). Among the patients who had surgery the ones with gangrenous gut on average stayed longer (7.3) than the ones with viable gut (4.1).

Figure 19: Type of treatment versus duration of hospital stay
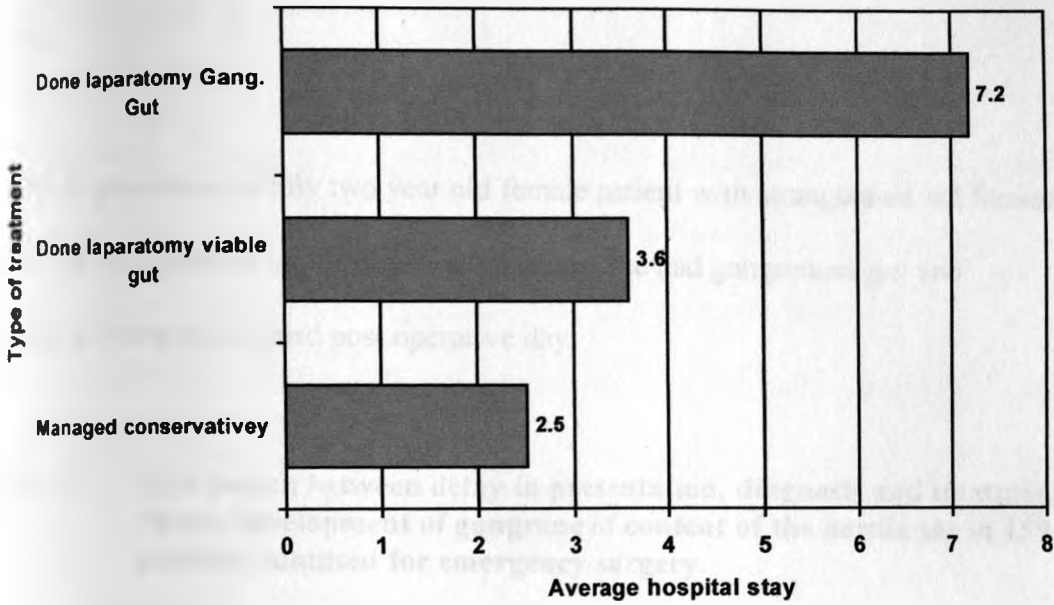
Mortality.

Four patients with strangulated hernia died during the study period. This gave a mortality rate of 4/188 approximately 2.1%.

The first patient was a 2 months old baby with strangulated umbilical hernia and necrotizing enterocolitis. He was admitted and operated on within 18 hours of admission. Laporatory findings included generalised bowel sepsis which was viable.

The second patient was also two months old and had gastroenteritis. He was operated on within 12 hours of admission and died a few hours after surgery. He had gangrenous gut.

The third patient was a ten week old with gastroenteritis. He died while being

anaesthesized on the same day he was admitted. Clinically he had strangulated inguinal

hernia.

The fourth patient was a fifty two year old female patient with strangulated left femoral

hernia She was operated on the day of admission. She had gangrenous gut and

peritonitis. She died on third post operative day.

Table 14: **Correlation between delay in presentation, diagnosis and treatment versus development of gangrene of content of the hernia sac in 159 patients admitted for emergency surgery.**

Time between onset of symptoms and treatment at KNH	Number of patients with viable gut	Number of patients with gangrenous gut	Mortality
<= 48 hours	112	9	121
> 48 hours	13	25	38

P= less than 0.01.

There is statistically significant relationship between delay in presentation and

development of gangrene.

DISCUSSION.

Incidence, age and sex patterns

Incidence

During the period of study (1994-1999) a total of 1797 patients with external hernias were seen at KNH, giving an annual average of 299.5 patients. Of this an average of 31 patients a year incarcerated or strangulated giving an incidence rate of 10.5%. Adesunkanmi A.R. et (40) reported an incidence rate of 7.7% while others like Ameh E.A. (41) reported a strangulation rate of 4.8%. The higher incidence in this study could be attributed to Kenyatta National Hospital having better surgical facilities and personnel than the neighbouring district hospitals.

The commonest types of external hernias in this study are inguinal (63.4%), umbilical (18.9%), epigastric (5.2%), femoral (0.7%) and miscellaneous hernias (11.4%) (omphalocoele, incisional etc). Pollack R et al (1) in their review had almost similar observation (in order) inguinal, femoral, umbilical, incisional and miscellaneous.

Inguinal hernias occur more commonly on the right (68.4%) than on left side (24.6%) and bilaterally (6.7%). Momoh T.J. (42) in his study of 510 children with external hernia had similar results – right side 54%, left side 35% and bilaterally 9%.

In this study, the commonest type of external strangulated hernia in order of importance are inguinal (80.9%), umbilical (12.8%), femoral (2.1%) and miscellaneous (2.1%). Besides, strangulation occur more commonly on the right (77%) than left (20.4%) or

bilaterally (2.6%). Thus the frequency of incarceration/strangulation is dependant only to the distribution of hernias in general. Andrew N.J observed that right sided hernia strangulated more frequently than left side hernias (8).

The site of external hernias is an important risk factor in the development of strangulation. In this study, 33.3% (4/12) of patients with femoral hernias strangulated: while only 13.3% (inguinal), 7.1 (umbilical) and 4.3% (epigastric) hernias. Rai et al (43) also made similar observation.

Rai et al (43) observed that duration of hernia for less than a year is an important risk factor in the development of strangulation in both children and adults. In this study, of patients with strangulation, 59.04% had hernia for less than three months and 68.08% for less than six months. Gallegos DC et al (44) too made similar observation.

Age.

Age is an important risk factor as it is associated with high morbidity and mortality especially at its extremes (the very young and the very old) (45.46). Deysine et al (45) observed that whereas elective abdominal herniorrhaphy carries morbidity and mortality of 26% and 1.5% in very young and patients over age of 65 years, these figures climb to 55% and 15% during the emergency surgery. In this study, 3 of the 4 patients who died were aged ten weeks. Heydon W.H. (46) also made similar observation.

Pollack R (1) observed that strangulation is a complication of the extremes of life, the average age of the patient being close to 65 years. Children (in his study) make up to 5-

10% of the patients, with most hernias presenting before the age of 2 years. This study contrast sharply with his study. The mean age is 26.1 years. Children form approximately 30% of the patients and elderly patients over 65 years form only 7.45% most patient are in the age group 21-50 years (48.4%). The explanation lies in the age structure of our population which is predominantly young (60% are below age of 25 years). The western population in comparison is predominantly elderly.

Sex.

In this study male sex predominate – 92.5% male to 7.5% female (ratio 12:1). Adesunkanmi AR (40), in his study like others elsewhere (42,43) arrived at similar result of 94.7% to 5.3% (18:1).

Although in general strangulation of external hernia occur predominately in males, . however, in certain type of hernia (femoral and epigatric) females predominate. In this study, inguinal and umbilical hernias occur more commonly in males than females (52:2 and 19.5 respectively). In femoral and epigastric hernias the ratio are female:male 4:0 and 3:1 respectively. Pollack R (1) in his study gave a similar finding inguinal Male:Female 8-10 (1) femoral M:F 1:4 umbilical 1:1 and incisional hernia (1:2-7). Similar finding were given elsewhere Dennis C. et al-1978 (11). .

Clinical presentation.

The most common symptoms in patients who presented with strangulated hernias were pain at the site of herniation (98.9%), local hernia swelling (97.9%), vomiting (73.9%),

obstipation (39.9%) and abdominal distension (37.8%). This agrees with studies done by Pollack R. (1) and Zimmerman L.M. (14).

Statistical analysis using chi-square test was done to correlate delay in presentation, diagnosis and management on one hand and development of gangrenes of gut showed there is association. Gellagos A.K. et al (44) reported similar findings. Andrew in his study (8) reported mortality and bowel resection were clearly linked with duration of symptoms prior to admission (8,9,10).

Predisposing factors.

Congenital factors in genesis of hernia include deficiency of collagen, congenital processus vaginalis among other predisposing factors and are very important (Anson et al 1960) (47).

Due to inadequate material in the files. study of congenital factors was not undertaken here.

Among associated factors in this study in order of importance include chronic cough twenty three patients (2.2%). straining at micturation nine patients (4.8%) and straining at defaecation (3.7%).

Treatment modalities.

Raymond Pollack (1) wrote early surgical therapy is the only rational approach to correcting of a strangulating hernia if severe morbidity or mortality is to be obviated. Stoppa R.E. also made similar observation (48).

In this study, 159 out of the 188 patients (or 84.57%) underwent emergency surgery, and the remaining 29 (15.43%) patients were managed conservatively. In the latter group, 8 patients had spontaneous reduction on arrival while 21 had their hernia reduced under sedation – mostly children.

Outcome of strangulation and treatment.

In this study, a total of 16 out of 188 patients had complications secondary to strangulation or treatment (i.e. a complication rate of 8.5%). Rydell (49) had an overall complication rate of 7%.

Seven patients had testicular edema or haematoma and only one had testicular atrophy. Koontz (50) observed that "atrophy of the testicle sometimes follows a simple primary operation for inguinal hernia repair, in which neither the collateral nor primary circulation has been molested as far as the surgeon is aware". Also Wantz (51) (1982,1986) observed that testicular atrophy is especially prone to occur after repair of an indirect complete scrotal hernia.

Four patients had post-surgical wound infection (2.1%) ( ). Nyhus L.M. et al (5) in their study recorded wound infection rate of 3% (4). Oluwole SF (52) in a Nigerian study reported an infection rate of 2.8%). Miscellaneous complications (one of each) include gut injury, loss of libido and mesenteric haematoma.

There were no patients with urinary retention: Nyhus L.M.et al (5) in their study observed that up to a third of patients undergoing inguinal hernia repair had urinary retention which usually involved two groups of patients, older men with Prostatic obstruction disease and young healthy muscle men. The latter group had this complication due to pre-operative atropine like drugs used and excessive post-operative analgesia. Besides, there were no patients with respiratory complication or cardiovascular complication which happen to be commonest complication in studies done in western world. Nyhus LM et al (1,5). Patients reported locally are on average (16 years) younger than the western counterpart (average of 65 years). The difference in complications between the two studies is attributed to relatively younger patients in ours study with no prostatic disease or cardiopulmonary conditions.

Mackenzie (1960) (39) observed that mortality doubled with development of gangrene. In his review he said "whereas only 7 to 10% of patients have gangrenous intestine, 40-45% of these patients can be expected to die post-operatively, regardless of the treatment used. However, Thorndike and Feruson (1938) commented that deaths appear to be function of the age of the population studied, geographical location and delay in presentation, diagnosis and treatment. Deaths in infants and children are excessively

rare, whereas elderly people and patients in the third world continue to have severe morbidity and mortality". In our study, 32 patients (i.e. 16.1%) had gangrenous gut and only 4 patients died (who were very young and had co-morbid conditions especially gastroenterisitis). This difference in mortalities in the two studies is attributed to younger population in our study who persevere the stress of surgery and anaesthesia better and have no cormorbid conditions.

CONCLUSIONS.

A retrospective study was carried out on the clinico-epidemiologic pattern and management of strangulated external hernias at Kenyatta National Hospital for the period of January 1994 to December 1999.

Findings:

1. a.　　An average of 300 patients a year were found to be having external hernias

   b.　　An average of 31 patients a year or 10.5% of patients with external hernias strangulated

2. The commonest types of incarcerated/strangulated external hernias are inguinal 63.4%, umbilical hernia 19%, epigastric hernias 5%, femoral 0.7%

3. Most incarcerated/strangulated external hernia (like non-strangulated external hernias) do occur on the right side (68.7%), (24.6%) do occur on the left side and 6% bilaterally.

4. Sex is an important risk factor. Strangulation of external hernia predominately occur in males. In our local study, the ratio was 12:1 (or 92.5% vs 7.5%).

5. Site of the hernia is an important risk factor and adults with femoral hernias were most likely to experience complications: In this study 4 patients of 12 with femoral hernia did strangulate) (or 33.3%) (compared inguinal one hundred and thirty two approximately 13.3%)

6. Extreme young age was found to be a risk factor and predicted complication in the very young. In this study, 3 out of 4 patients who died with strangulated external hernias were children aged ten weeks

7. Mortality was high in patients with co-existing diseases, while morbidity was affected by viability of gut. In our study, 3 of the four patients who died had co-existed gastrointestinal infection and the hospital stay for patients with gangrene gut was longest comparatively.

8. The mean age of patients with strangulated external hernias was 26.1% years and the commonest age group affected with strangulation is 21-50 (48.4%).

9. The commonest presenting symptom and sign are local hernia site pain (98.94) and local hernia swelling (97.87) respectively.

10. Commonest complication in the study include testicular edema/haematoma 3.7% and wound infection (2.1%).

RECOMMENDATIONS

1. Early repair of hernias before complication sets in. The general population and affected patients in particular should be educated on the need of early repairs.

2. Patients with short history of hernia should be referred urgently to hospital for surgery as they tend to strangulate more commonly than their counterpart with longer history

3. Certain types of external hernia strangulated more easily than others. Femoral hernias – have increased incidence of complication. Thus they should be operated on earlier

4. REFERENCES.

1. Pollack R.
   Strangulated external hernias
   In. HERNIA by NYHUS, L.M. and R.E. Condon
   3rd Edition, Lippin Cott Company 1989 – pg 273-284

2. Hall – Craggs. E.C.B.
   Sigmoid Volvulus in an African population
   British Medical Journal
   1960; 1:1015-1017

3. Chiedozie. I.C., Aboh I.O. and Poserchia N.E.
   Mechanical intestinal obstruction: a review of 316 cases in Benin City
   American Journal of Surgery
   1980:139. 389

4. V.M. Muyembe and N. Suleiman
   Intestinal obstruction at a provincial hospital in Kenya
   East African Medical Journal
   2000: 77, 88; pg 440-443

5. Nyhus L.M.. Stewardson. R.H. and Bombeck C.T.
   Critical operative management small obstruction
   Annals of Surgery ·
   1978:107:189

6. Mc Entee G.. Pender S.. Mulvin D
   Current spectrum of intestinal obstruction
   British Journal of Surgery
   1987:74:977-980

7. Ekueme O.
   Strangulated external hernia
   British Medical Journal
   1973. 60:930

8. Andrews N.J.
   Presentation and outcome of strangulated external hernia in a district hospital
   British Medical Journal
   1981:68. 329-332.

9. Beller A.J. and Colp R.
   Strangulated hernia from standpoint of viability of the intestinal content
   Arch of Surgery
   1926:12: 901-918

10.   Frankau C
      Strangulating hernias; A review of 1987 cases
      British Journal of Surgery
      1932: 19: 176-199

11.   Denis C., and Enguist I.F.
      Strangulating external hernia
      In: Hernia textbook, by Nyhus and Condon, R.E.
      By Lippincott Company 3rd edition
      1978: 279-299

12.   Condon R.E.
      Strangulating hernias
      In: Hernia textbook, by Lippincott Ltd 3rd edition
      1989: 3:284

13.   Ellis H. and Calne R.Y.
      Hernia
      In: Lecture notes on general surgery
      Blackwell Scientific Foundation. 1977: S 252-262

14.   Zimmerman, L.M. and Anson B.J.
      Hernia in general
      In: Anatomy and Surgery of hernia
      1967: 2: 15-44

15.   Cobb R., MchWhinnie, D.L. et al
      Hernias
      In: Volume II: OXFORD textbook of surgery, by OXFORD Medical
      Publications First edition
      1994:1: 1399-1417

16.   Mahour G.H., Weitzman J.J and Rosen Krants J.G.
      Omphalocoele and Gastroschisis
      Ann. Surgery
      1973: 177:478

17.   Moore, K.L.
      Malformation of the midgut: Pathology
      In: The developing human,
      1982, by W.B. Saunders Company 3rd edition
      242-243

18.   Gough D.V.S.
       Inguinal hernia and hydrocoele in childhood
       Surgery International
       1991: 16: 2359-61

19.   Giles C.R. and N.A. Halasz
       Abdominal wall and hernias
       In: Essential surgical practice. 3rd edition
       by Butterworth HeinnMann Company Ltd.,
       1995:3: 1433-1445

20.   Blausfed T.B. and Welin Burger T.
       Incisional hernia
       Acta Chir Scand
       1972, 138; 275

21.   Mann, C.V.
       Hernias. Umbilical and abdominal wall
       In: Bailey and Love's short practice of surgery
       ELNS with Chapman and Hall 22nd edition
       1995: 22: 885-903

22.   A.J. Dickenson and Leaper D.J.
       Wound dehiscence and incisional hernia
       Surgery International
       1999. 47:230-232

23.   Laufmann H. and Daniels J.
       Clinical factors affecting mortality in strangulated hernia
       Arch. Surgery
       1951:62:365

24.   Keenan R.A. and Jones P.F.
       Strangulated hernias
       In: Emergency abdominal surgery
       by Chapman and Hall Company 3rd edition
       1998:3:14-226

25.   Jens J
       Strangulated femoral hernias
       The Lancet
       1943: 1: 703

26.　Barry H.C.
　　　Fibrous structures of small intestines following strangulated hernia
　　　British Journal of Surgery
　　　1943:30-64

27.　Gillipsie R.W., Mertz GH and MuSelman M.M.
　　　Ritcher's hernia: its etiology, recognition and management
　　　Arch. of Surgery
　　　1956: 73:590

28.　Wright R.N., Aresnamn R.M., Coughlin T.R., Nyhus L.M.
　　　Hernia reduction en Masse
　　　America Journal of Surgery
　　　1977, 43:277

29.　Moss. C.M., Levine R., Messenger N and Dardik I
　　　Sliding colonic Maydi Hernia: Report of a case:
　　　In: Journal of disease of rectum and colon
　　　1976; 19:636

30.　Reguarth W. and Theis
　　　Incarcerated and strangulated inguinal hernia
　　　Archives of Surgery
　　　1948: 57:267

31.　Mowschenson, P.M.
　　　Treatment of hernias
　　　In: Aids to undergraduate Surgery, First edition
　　　1978: 1:100-104

32.　Campbell D., and Spence A.A.: Selected local and regional techniques
　　　In: Norris and Camphells, 2nd edition
　　　Anaesthetic resuscitation and intensive care
　　　1978: 5: 204-221.

33.　Brendan H.D.
　　　Inguinal hernia: Surgery
　　　1983: 2: 38-43

34.　Johnstone J.M.S. Rintoul. R.F.
　　　Operation for hernia
　　　In: Farquharson's textbook of operative surgery
　　　Seventh edition; 1986:7:487

35.   C.G. Eden
       Choice of suture material
       Surgery International
       1992:16:11

36.   Kingsnorth A.
       Adult groin hernias: acute and elective
       Surgery International by the Medicine publishing Co. Ltd.
       1999: 47:232-238

37.   McNealy R.W., Litchenstern M.E., and Todd M.A
       The diagnosis and management of incarcerated femoral hernia
       Surgery Obst. Gynecol
       1942: 74: 1005

38.   Dennis C. and Varco R.L.
       Femoral hernia with gangrenous bowel
       Surgery Obst. Gyn.
       1947: 22: 312

39.   Mackenzie L.
       Management of strangulated hernia
       Surgical clinics North America
       1960:40: 1367

40.   Adesunkanmi AR., Adejuyigbe O., Agbakwuru EA.
       Prognostic factors in childhood inguinal hernias
       East African Medical Journal
       March 1999: 76(3): 144-7

41.   Ameh E.A
       Incarcerated and strangulated inguinal hernias in children
       East African Medical Journal
       Sept. 1999: 76(9): 499-501

42.   Momoh TJ.
       External hernia in Nigerian children
       Ann. Trop. Paediatrician
       Dec. 1985:5:4:197-200

43.   Rai S.; Chandra SS., Smile SR
       A study of the risks of strangulation and obstruction in groin hernias
       Australian and NZ Journal of Surgery
       Sept. 1998: 68(9): 650(4).

44. Gallegos DC., Dawson J., Jarvis M., Hobskey M.
     Risk of strangulation in groin hernias
     British Journal of Surgery
     Oct. 1999 : 78(10): 1171-3.

45. Deysine M., Grimson R., Soroft HS
     Herniorrhaphy in the elderly
     American Journal of Surgery
     April 1987; 153(4):387-91

46. Heydon WH., Velanovich V.
     A five year US army experience with 36.250 abdominal hernia repair
     American Surgery
     Oct. 1990: 56(10): 596-600.

47. Anson BJ.,, Morgan EH. and McVay CB
     Surgical anatomy of the inguinal region base upon a study of 500 body halves
     Surgical Obst. gynecol
     1960:111:707.

48. Stoppa RE
     Treatment of complicated groin and incisional hernias (review) (66 refs)
     World Journal of Surgery
     Sept.-Oct. 1989: 13(5): 545-54.

49. Rydell WB Jr.
     Inguinal and femoral hernias
     Arch. Surgery
     1963:87:493

50. Koontz AR
     Atrophy of testicle as a surgical risk
     Surgery obstet gynecol
     1965:120:511.

51. Wantz GE
     Testicular atrophy as a sequele of inguinal herniorrhaphy
     Int. Surgery
     1986:71:159.

52. Oluwole SF., Lawal OO.
     Factors influencing the morbidity of strangulated inguinal hernia in Ife.
     Nigeria
     East African Medical Journal
     1984:vol. 61 No. 11:817

STANDARD QUESTIONNAIRE FORM

NAME

ID NUMBER

AGE   SEX

OCCUPATION LENGTH

HISTORY/PRESENTING

	YES	NO	DURATION
Pain			
Vomiting			
Obstipation			
Abdominal distension			
H/O previous obstruction			

PREDISPOSING FACTOR REVIEW (Non-congenital)

	YES	NO
History of chronic cough		
History straining at micturation		
History straining at defecation		
History chronic obesity		
History of pregnancy/multiparity		

PREDISPOSING FACTOR REVIEW (Non-congenital)

EXAMINATION	YES	NO
Right inguinal		
Left inguinal		
Bilateral inguinal		
Femoral		
Umbilical		
Epigatric		
Para-umbilical		
Omphalocoel		

TYPE:	YES	NO
Incarcerated viable content		
Strangulated content		

MANAGEMENT:	YES	NO
Observation/conservative management		
Emergency operation		
Elective operation		
Antibiotics give		
Prophylactive		
Post operative		

COMPLICATION

	YES	NO
Wound infection		
Gut injury		
Bladder injury		
Testicular atrophy		
DEATH		
Cardiopulmonary		
Cause of death age		
Hospital stay length		
Recurrence		