

A REVIEW OF THE INITIAL MANAGEMENT OF SKIN AND  
SUBCUTANEOUS TISSUE AVULSION INJURIES

OCTOBER – 1999 --- SEPTEMBER- 2000

By Dr. J. B. O. Wawiye

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DEDICATION:

To my late dad who believed in me more than I believed in myself.

**AKNOWLEDGMENTS:**

Prof. Atinga, Prof. Ogendo, Dr. Kireti, Staff of ward 6C and 6A KNH, Mr. Omondi and Mr. Oyugi of KAVI, Ken and George of PC World.

A DISSERTATION TO BE PRESENTED AS PART OF  
THE REQUIREMENT FOR M.Med (SURGERY).

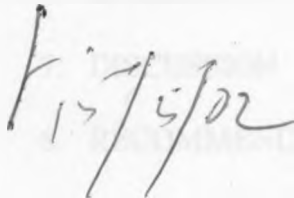
DECLARATION; -

I HEREBY CERTIFY THAT THIS DISSERTATION IS MY OWN ORIGINAL WORK AND HAS NOT BEEN PRESENTED FOR A DEGREE IN ANY OTHER UNIVERSITY.

CANDIDATE; DR. JOSEPH BENEDICT OTIENO WAWIYE

SIGNED:

DATED:

  
15/5/02

THIS DISSERTATION HAS BEEN SUBMITTED FOR EXAMINATION WITH MY APPROVAL AS UNIVERSITY SUPERVISOR.

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**ABSTRACT:****OBJECTIVES:**

To study skin and subcutaneous tissue avulsion injuries with the aim of finding the pattern, aetiology, management and outcomes, as seen in Kenyatta National Hospital.

**DESIGN:**

A retrospective and prospective follow up study.

**SETTING:**

The Kenyatta National Hospital, Nairobi, between October 1<sup>st</sup> 1999 – September 30<sup>th</sup> 2000.

**SUBJECTS:**

Twenty two patients seen at Kenyatta National Hospital between October 1<sup>st</sup> 1999 and September 30<sup>th</sup> 2000, with Skin and Subcutaneous Tissue Avulsion Injuries.

**RESULTS:**

There were nineteen males and three females. The youngest was six months old, while the eldest was aged sixty-five years. Road traffic accidents accounted for most of the injuries, most being of moderate severity. The outcome was good, with only two patients having confirmed poor results. Follow up was however very poor with only seven patients returning.

**CONCLUSION:**

The method of management of degloving injuries in Kenyatta National Hospital is essentially satisfactory with only two poor results in this study.

## INTRODUCTION:

In a degloving injury, an extensive area of skin is torn from its underlying attachments and thereby deprived of its blood supply. In the hand or arm, the limb being crushed by rollers commonly causes this. In the leg it may result from the shearing effect of a vehicle wheel passing over the limb in a run-over accident.

The skin may remain unbroken resulting in a closed degloving injury in which case the limb feels like a fluid containing bag owing to the presence of an extensive haematoma between the skin and fascia. If the skin is torn resulting in an open degloving injury the effect is the creation of a large flap of full-thickness skin. In either case, massive sloughing is likely unless the injury is properly managed. A number of plastic surgical procedures are available. The best method, if facilities are at hand, is the following:

The flap should be excised, first marking it, and the defect, so that it may be re-orientated later. The flap is then stored in a sterile container, in a refrigerator.

The wound should be debrided, and the conditions optimised for the formation of a local bed of granulation tissue. After one to two weeks the stored skin is replaced as a single sheet graft, after the deeper layers have been removed (1).

Skin and subcutaneous tissue avulsion injuries occur in many trauma patients both in Kenyatta National Hospital and in the District hospitals. Mismanagement can result in scarring and contractures with deformities and loss of function, even loss of limbs. Skin is also the primary barrier in protecting the body against invasion by pathogenic organisms. It is recommended that the avulsed skin be defatted and used as a primary full thickness skin graft (2, 3).



Avulsion injuries or crush avulsion injuries are open injuries where there has been a severe degree of tissue damage, such injuries occur when hands or limbs are trapped in moving machinery such as rollers producing a degloving injury. Tissue is avulsed usually from the level of deep fascia either by direct action of the machinery itself or by the injured person reflexly withdrawing the limb. In road traffic accident friction from rubber tyres avulse skin and subcutaneous tissue from the underlying deep fascia. Such injuries are usually open but on occasion they may be closed with no skin laceration apparent. The patient may simply present with severe bruising and perhaps skin sensory disturbance.

The history should raise the examiners suspicion and it is often possible to pinch the skin and lift it upwards, revealing the detachment from normal anchorages. There is devascularization of the avulsed tissue and skin necrosis will occur in the subsequent few days. Even tissue, which demonstrates venous bleeding, may subsequently undergo necrosis if circulation is insufficient.

In this study we hoped to see what were the methods most commonly used in the management of degloving in Kenyatta National Hospital and what were the outcomes.

## LITERATURE REVIEW:

In 1869 J. L. Riverdin, identified islets of granulation tissue growing from the centre of wounds, especially in burns (4).

Two years later, George Lawson, had successfully performed free full thickness skin grafts the size of 32cm and 16cm (5). After the left upper eyelid of a patient was completely destroyed by lupus, he provided a new covering for the lid by transplantation of pieces of skin from the arms.

In 1874 Prof. Dr. Carl Thiersh, observed that in grafts, the healing process takes place without a structure less substance of adherence (6).

In 1875 J. R. Wolf, described the first graft where he removed fat and areolar tissue, attempting to leave only the dermis and epidermis of the skin (7).

Prof. Fedor Krause described the transplantation of large unpedicaled skin flaps. He too had defatted the flaps (8).

In 1908 Prof. Otto Lanz of Amsterdam described the first mesh made of razors to expand the harvested skin (9).

Next to the pedicled or sliding flap, a successful free skin graft of practically full thickness will most closely duplicate the natural surface. Full thickness is appropriate for freshly made wounds, clean raw surfaces, where substantial protection is required, where maximal mobility is required and where minimum subsequent scarring should occur. It provides a natural appearance, and is usually used in areas of contractures, webbed fingers, burns, flexor surfaces of joints, where the full thickness of a scar has to be removed to relieve contraction. It is used on fresh granulating surfaces, on freshened scar surfaces and surfaces that will resist contraction or where

allowances can be made for such contraction, if appearance and demand for function do not contraindicate their use.

Thinner grafts are used because of their comparative simplicity and greater certainty of "take". This includes the back of the hands, except the knuckles subcutaneous tissue of the face, Obicularis Oris, Obicularis Palpebrum, where a split graft of some thickness is in most cases the one of choice.

There are factors associated with a thinner graft, which if ineptly applied may seriously affect the final results, these are, the thinner graft may not give sufficient protection to the bearing surface, due to its thinness, it will not correct the irregularities of the underlying surface.

The thinner graft is placed on a freshly raw surface with moveable base and moveable edges, such as the area of subcutaneous tissue of the neck, which may subsequently contract without any loss of epithelium and the contraction may be as much as 60%.

Contraction does not take place in the graft itself, but in the layer of scar tissue that unites the graft to its new bed. In a full thickness graft the dermis seems to a large extent to have the power to resist this contraction. Contraction in the areas from which the graft has been taken occurs due to, infection from organisms liberated from sweat and sebaceous glands at the time the graft was harvested and movement or pulling at the dressing. (10)

#### TYRE INJURY:

A moving tyre dragging the limb frequently against the curb produces this. Soft tissue injury is more pronounced and avulsion is extensive. Exposure of bone,

joints and nerves is common and should stimulate the need for primary wound closure.

Treatment consists of cleansing the wound, application of an occlusive dressing and elevation of the limb. Healing is usually slow but satisfactory taking about 4 – 6 weeks with no inconvenience to the patients who can assume their day-to-day activities. This and other avulsion injuries may be associated with viable skin flaps, which may be sutured directly or if the circulation appears inadequate, removed, defatted and returned as free full thickness skin grafts.

#### CRUSH INJURY:

Strong compression- bursting forces produce superficial and deep damage that can involve all structures in the area. Later swelling is extensive with necrosis of superficial and deep tissue is common, often becoming apparent a few days after injury. Serious consideration must be given to releasing tension by evacuation of the haematomas existing in elastic dead skin (escharectomy) or performing a faciotomy if the circulation to the area shows evidence of impairment (1).

#### SHARP AVULSION:

This type of avulsion results from a force that separates the skin and subcutaneous fat from the fixed deep structures in a clean and tidy manner. The main consideration in the emergency department is whether the flap is likely to survive. This depends on the blood supply to the region, the relationship of the flap to the axial blood flow, the flap width, length and thickness.

If the flap is of questionable viability, this is an ideal injury for the total removal, defatting and replacement as a free full-thickness skin graft. This decision can be difficult (1).

#### DEGLOVING INJURIES:

This type of wound is often much more than it appears in the emergency department for reasons somewhat similar to those in sharp avulsion but on a greater scale. Both the laceration and the degree of avulsion are extensive. The tissues usually have suffered extensive crushing, abrasion and burning. Degloving injuries may be partial or total.

In partial degloving injuries, excising the avulsed portion and converting it into a free full thickness or partial thickness skin graft can salvage tissue. Severely damaged tissue may be discarded and replaced by partial thickness grafts from carefully selected donor sites.

In total degloving injuries, the whole part is completely denuded of soft tissue cover and there are usually injuries involving much deeper structures such as joints, nerves, bones, tendons and vessels. Salvage is possible in some of these conditions and the flap may be replaced with success. However we sometimes are in error and the assessment of the injury proves to be inaccurate as evidenced by subsequent flap necrosis. If this occurs, patience and skin graft replacement are the best treatment.

In some severe degloving injuries there is such extensive injury to the deep structures as to bring into question the survival or future usefulness of the extremity. In some cases amputation may be required rather than attempts in soft tissue replacement or skin graft coverage. The decision for amputation should be made in consultation, and the basis for it documented in writing (2).

Degloving injuries are associated with major morbidity. At the University of the Witwatersrand, Johannesburg, South Africa, flap viability assessment was based on surface dermal capillary bleeding, split skin was then harvested from the surface of the flap and the skin grafts were then used to cover the denuded areas. This technique proved to be effective, time saving and morbidity reducing in the cases reviewed (11). Hoogboom, Polley, Hunsted, Scholten and Telman describe the in vitro preservation of human skin autografts as a valuable technique in the management of severe degloving injuries (12).

After degloving injuries of the heel, the unique vascularization of the sole may lead to ischaemia and consequently soft tissue necrosis. Revascularization of degloved heel pads by reconstruction of the medial calcaneal branch of the posterior tibial artery is recommended as a salvage procedure (13).

Being struck by a vehicle commonly caused avulsion injuries to the foot. Reconstruction using fasciocutaneous flaps have yielded promising results (14).

While varying in severity a classic digital injury results from inadvertently catching the ring on a finger on a fixed object. Often there is complete avulsion of the soft tissues of the fingers including the neurovascular bundles, in which case amputation of the denuded skeleton is the only solution to offer. Initially simple wound closure should be done while secondary procedures to improve balance of the hand may be considered later.

When the problem is basically skin loss, but the resulting wound surfaces are unsuitable to successfully accept a skin graft, the part may be buried in an abdominal pocket for 10 days. The wound surface resulting from dissection to free the finger from the abdomen should be suitable for grafting. This method obviates the tissue bulkiness common to circumferential distant flaps. Still, in the finger, digital transposition or amputation with removal of metacarpal head to give good cosmetic results and restore balance is generally the best treatment and the attitude towards protracted multi-staged reconstruction should be conservative (15).

Wound coverage after a complete degloving injury of the hand and fingers is one of the most difficult problems in hand surgery. Important structures such as tendons, nerves and bones are exposed and will necrose if not covered adequately. The goal of treatment should be coverage with a pliable, sensitive and cosmetically similar tissue that will allow early mobilization. The following general guidelines can

be used, re-implantation of the avulsed structures whenever possible, early transfer of a free composite flap from the foot for a complete and irreparable degloving injury of the thumb and selection of radical forearm flaps for multiple finger lesions (16,17,18).

Restoration of function following mutilating injuries to the extensor surface of the hand has traditionally involved staged reconstruction with distant pedicle flaps, followed by tendon grafting. Advances in microsurgery now permit the transfer, in one operation, of the vascularized composite tissues such as skin and muscle or skin and bone. For dorsal reconstruction a composite flap of skin, tendons and nerves from the dorsum of the foot was transferred in one stage soon after injury avoiding unnecessary disabling scar formation, prolonged hospitalisation and resulting in rapid restoration of normal function and appearance of the hand. Donor site morbidity was minimal (19,20).

When skin is missing from a scalp wound, the limitation factor to wound closure is often the inflexibility of the incisions in the galea; a moderate deficit may be closed. However when large areas of scalp are missing, more rational extensive rotational skin flaps are required. Skin grafts will only take on a layer of intact pericranium (21). Trapezius flaps, based on the transverse cervical artery can also be used to cover defects of the neck, face and scalp (22).

The immediate surgical care is similar to the supportive care given to any patient who has suffered the trauma. Haemorrhage and shock accompany any extensive wound and blood transfusion may frequently be indicated to correct the blood loss and secondary hypovolemia. The wounds are thoroughly cleaned and lightly debrided under general anaesthesia. The denuded area should then be



converted into a closed one as soon as possible. The management then depends on whether or not the periosteum is present or not.

When the periosteum is present, early conversion of the extensive open wound into a closed one with autogenous skin grafting remains the method of choice. The ability of the periosteum to support and nourish a skin graft has been well established. Thick split thickness skin grafts provide a much more stable covering than the thin Thiersch graft but require careful suturing and adequate fixation. Repeated attempts to utilize the full thickness of the scalp have generally met with failure.

When periosteum is destroyed, the exposed bone needs to be covered since the outer table of the calvarium receives its blood supply from the scalp through the periosteum. This should be either by a local flap in moderate and even large sized defects or by a flap from a distant site. In the scalp all the arteries tend to the vertex, anastomose freely, and form a rich network. The mobility and abundant blood supply of the scalp permit the closure of large areas with hair bearing scalp by transposing large and long flaps on a narrow pedicle. The closure of the defects by mobilisation, rotation and advancement of local flaps is the method of choice. The non-stretchable scalp can be made to cover a large area by multiple incisions through the galea. The surrounding tissues are stretched after undermining the plane between the galea and pericranium raising the flaps and making a number of vertical incisions through the non-stretchable galea. This may be criss-crossed with similar horizontal incisions to relieve the tension and permit return of the flaps to their original position without compromising the blood supply.

If soft tissue coverage is not provided the outer table of the cranial bone undergoes necrosis. Exfoliation may be accelerated by drilling a series of burr holes

through the outer table of the cranium. Granulation tissue growing up from the diploe eventually joins and provides a base that will accept a skin graft. A more rapid method is to remove the eburnated dead bone with an osteotome down to bleeding bone. In a week to ten days granulations cover the area and will accept a thick split-thickness skin graft. For smaller scalp defects that are not amenable to coverage by local flaps, the outer table can be burred down until pinpoint bleeding is noted. A split-thickness skin graft can be successfully applied on such a bed without any delay. Large losses of the scalp and cranium secondary to burns cannot be repaired with local scalp flaps if the surrounding tissue is subject to circulatory and dystrophic alterations. Such a condition is often seen in the recurrent carcinoma treated by irradiation. These defects are best repaired with an abdominal jump flap or a tube flap transferred to the arm as an intermediate carrier. It is necessary to remove all necrotic bone and repair the defect with a flap transferred from a distant site. Then at a later date, split bone grafts inserted under the flap can provide protection for the underlying brain.

McLean and Bunck (1972) employing microsurgical revascularization techniques covered a cranial defect with a free omental transplant anastomosed to the superficial temporal artery and vein. The omentum in turn was covered with a skin graft (22).

Traumatic eyelid avulsion is reported infrequently. It is suggested that the tissues should be immersed in saline and stored at 4 degrees Celsius. If implantation time is <6hrs, storage in a cold moist environment is adequate (23).

The nose is the most frequently traumatized portion of the human face. High-speed motor vehicle accidents and interpersonal violence commonly produce bony pyramid and septal damage and occasional minor soft tissue damage. Major soft tissue injuries

are much less commonly encountered. Avulsion injuries of this type may involve skin only or the bony cartilaginous framework as well (24).

Penoscrotal avulsion injuries are rare surgical emergencies. The best treatment for penile avulsions is split grafting. Scrotal skin avulsions require additional judgement for treatment, since there are several treatment options available. Scrotal skin remnants must be used to cover the defect whenever possible (25).

Bereta, Di Giuseppe, Vaccarella, Marzotto, and Zanollo described a case of reconstruction after penoscrotal avulsion. Two full thickness grafts helicoidally placed to avoid retractions provided penile coverage. Scrotal reconstruction was carried out in two steps, subcutaneous implantation of the testis, then axial flaps expanded in the abdominal region. The procedure has the advantage assurance of flap viability and avoids patient discomfort produced by perineal expansion with satisfactory cosmetic appearance and restoration of a normal sexual function (26).

#### OBJECTIVES AND RATIONALE OF THE STUDY;

The objectives of the study was to find the pattern and aetiology of skin and subcutaneous tissue avulsion injuries seen in Kenyatta National Hospital over a one year period. The study intended to determine what were the different methods used to manage these injuries, and how the management methods chosen related to the final outcome.

It was also intended to determine how different parameters such as age, sex, time interval from surgery and severity of injury were related to the final outcomes.

Science is not static and new discoveries are constantly being made. It is hoped that the study would help stimulate further research in this field and also help

set up a protocol for the management of skin and subcutaneous tissue avulsion injuries, which would leave patients looking as normal as possible and which could be later used as a reference.

## **MATERIALS AND METHODS:**

This was a retrospective and prospective follow up study on the management of patients admitted to Kenyatta National Hospital with skin and subcutaneous tissue avulsion injuries over a one-year period.

All patients admitted with degloving injuries into the surgical wards during the study period extending from 1<sup>st</sup> October 1999 to 30<sup>th</sup> September 2000 with both dates inclusive, who were able to communicate formed the study population. The aim of the study was explained to the patients, their parents or guardians and a verbal consent obtained.

The patients should have sustained a degloving injury, that is, the skin and subcutaneous tissue should have been avulsed. This could also include avulsion of skin appendages. The operation notes and post-operative treatment sheets were reviewed and analysed for the intra-operative findings of the operating surgeons, the procedures they used and the post-operative treatments and instructions that were given respectively.

A questionnaire was designed to record the age, sex, in patient number, past medical history, family and social history, date and time of admission and the initial surgical management and findings intra-operatively, subsequent post-operative management, complications if any and the date and time of discharge from the ward. Each patient was then given a thorough general examination, followed by a systemic

examination. The wound was then examined, its size, depth and extent was measured and these were recorded. The Red Cross Wound Classification System (27) was adopted with some modifications to determine the severity of the degloving injuries. These were then graded into mild (grade 1) small size measuring less than 5 square centimetre, moderate (grade 2) measuring between 5 and 10 square centimetres and extensive (grade 3) measuring greater than 10 square centimetres.

The time it took before theatre was available for the patient was recorded and the type of post-operative management used in the ward was determined and any subsequent surgical procedure that may have been used was also recorded.

On returning to the ward, any antibiotics used on the patient were recorded and also the results of any culture and sensitivity from pus swabs taken from the patient both pre-operatively and post-operatively. A record was also made of any antibiotics used, and any similarities with the laboratory results.

A note was made of the presence or absence of any complications that may have occurred. Their duration of stay in the wards was noted.

On discharge, the date and time given for the patient to attend the outpatient clinic for follow-up was noted and the wounds were re-examined at the clinics. In the case of those who did not return for follow up attempts were made to find out what were the causes for their inability to return. The patients who returned for follow-up were graded according to outcomes into good and poor; good outcomes were those with full restoration of form and function as near as normal as possible with the patient able to resume their normal occupation without difficulties. The appearance should also be as near normal as possible.

The individual parameters were recorded and analysed by computer using the statistical programme for social sciences (s.p.s.s. version 9.0) and compared with final outcomes. The results were presented in the form of tables and bar charts. The final results were discussed and conclusions and recommendations were drawn.

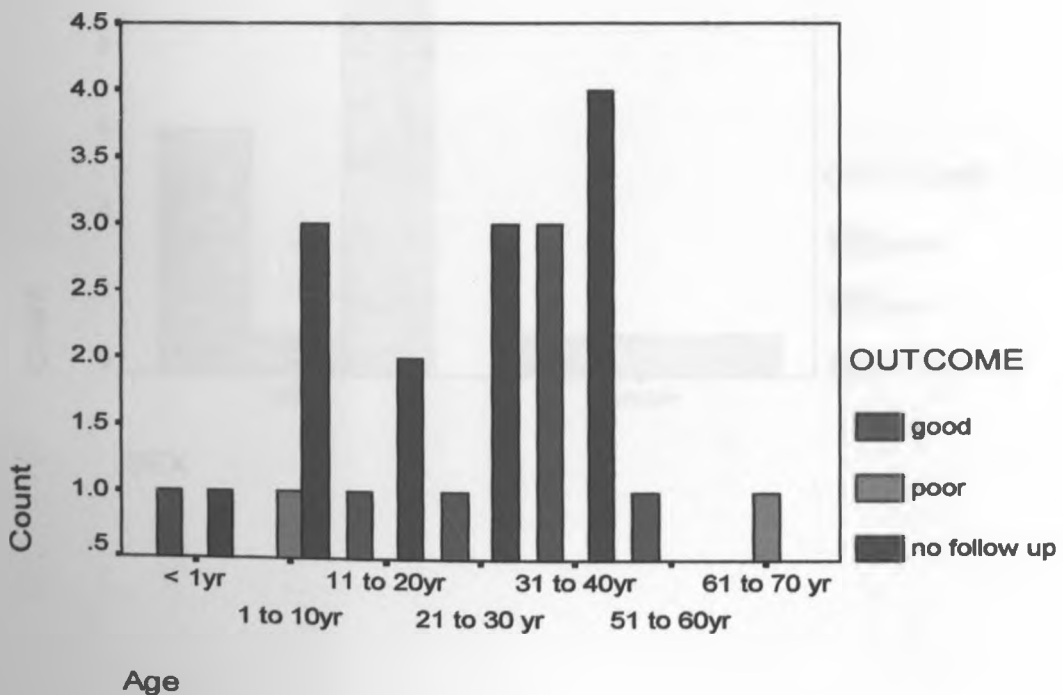
Those who sustained thermal burns, or who were seen at Kenyatta National Hospital casualty but were subsequently transferred to other hospitals, or who sustained degloving injuries but were not seen at the hospital, died at the scene of the accident or on arrival at casualty, before any surgical management could be attempted, were excluded from the study.

The study was limited by poorly recorded notes, resulting in incomplete or absent information. There were lapses in supply of materials, resulting in variations in the management of the patients, which did not correspond with the post-operative instructions. The number of patients sustaining degloving injuries was also very small, and the time period was also limited. Due to inability to get access records from the other health institutions, we were unable to compare their experiences and results with that of Kenyatta National Hospital.

The study protocol was approved by the Kenyatta National Hospital Ethical Research Committee, reference number: K.N.H- E.R.C /01/1118, Dated: 8<sup>th</sup> August 2001.

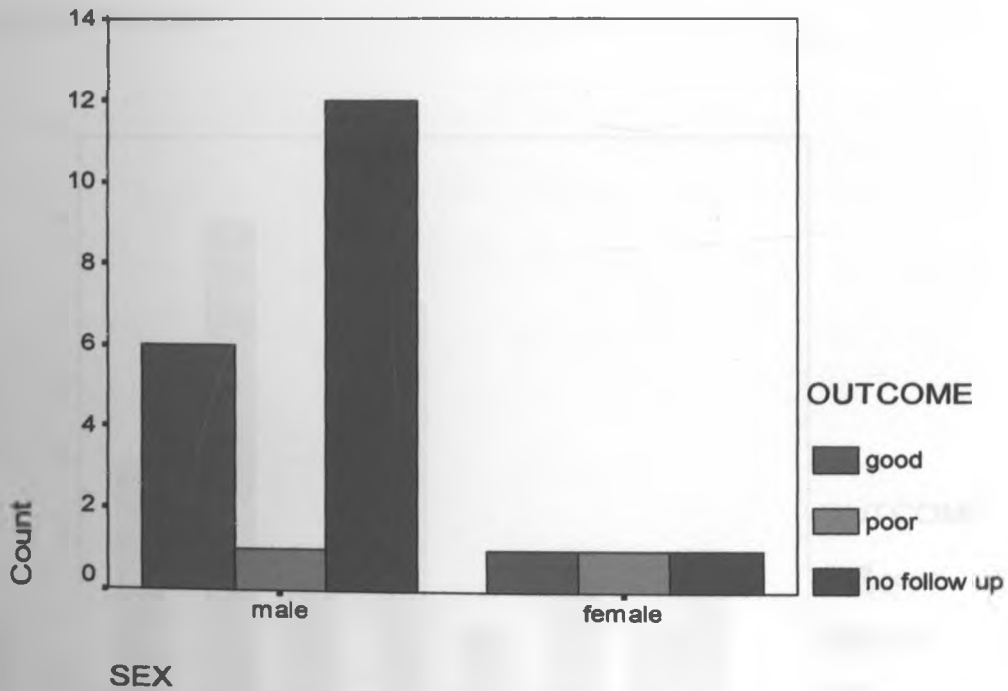
## RESULTS:

About 252 patients were admitted to Kenyatta National Hospital between 1<sup>st</sup> October 1999 and 30<sup>th</sup> September 2000, with soft tissue injuries. From these only twenty-two satisfied the criteria for the study. The youngest was six months old, while the oldest was sixty-five years old. The majority of the patients were in the thirty one to forty year age group, with seven patients, of which three had a good outcome, while four did not attend any follow up clinics. The twenty one to thirty year age group were next with four patients, one with good results and three who did not attend any follow up clinics. Children aged one to ten years also had four patients, one had poor results, and three did not return for follow up. The eleven to twenty year age group had three patients one with good results and two did not attend follow up. Those less than one year were two, one with good results, the other did not return for follow up. The fifty one to sixty year age group had one patient with good results. Finally the sixty one to seventy year age group had one patient with a poor outcome.



		OUTCOME			Total
		Good	Poor	No Follow-up	
Age	< 1yr	1		1	2
	1 to 10yr		1	3	4
	11 to 20yr	1		2	3
	21 to 30 yr	1		3	4
	31 to 40yr	3		4	7
	51 to 60yr	1			1
	61 to 70 yr		1		1
Total		7	2	13	22

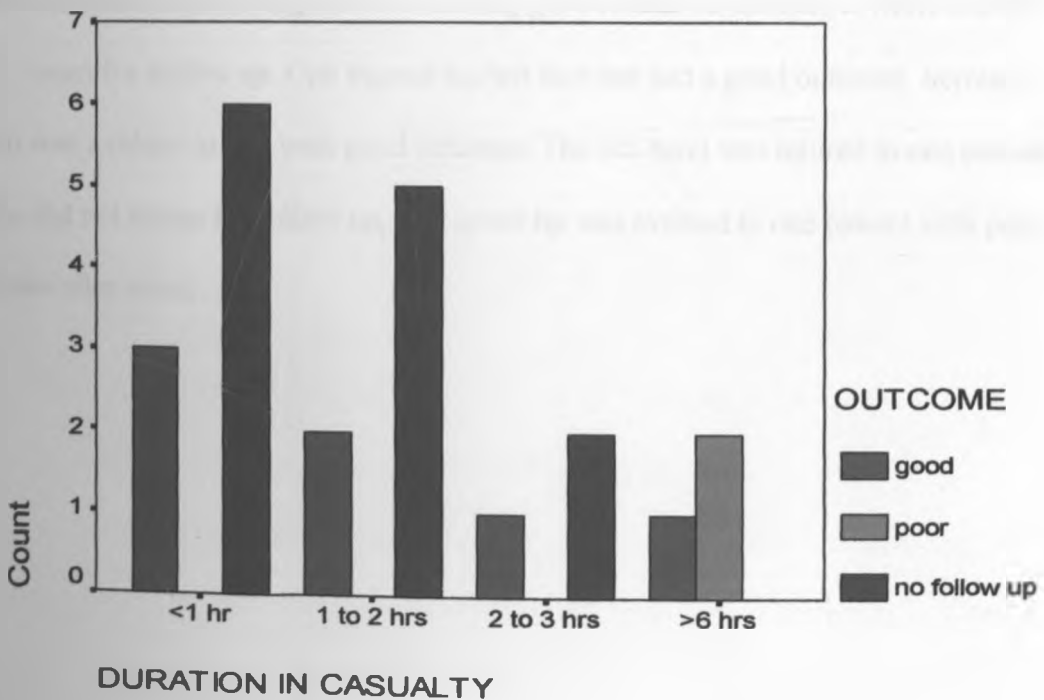
Males were the majority with nineteen of the patients giving a m:f ratio of 19:3, of these twelve did not attend the follow up clinics. Among those who attended, six had good results, while one had poor results. Females were only three with one having good results, one having poor results and one not attending follow up clinics.





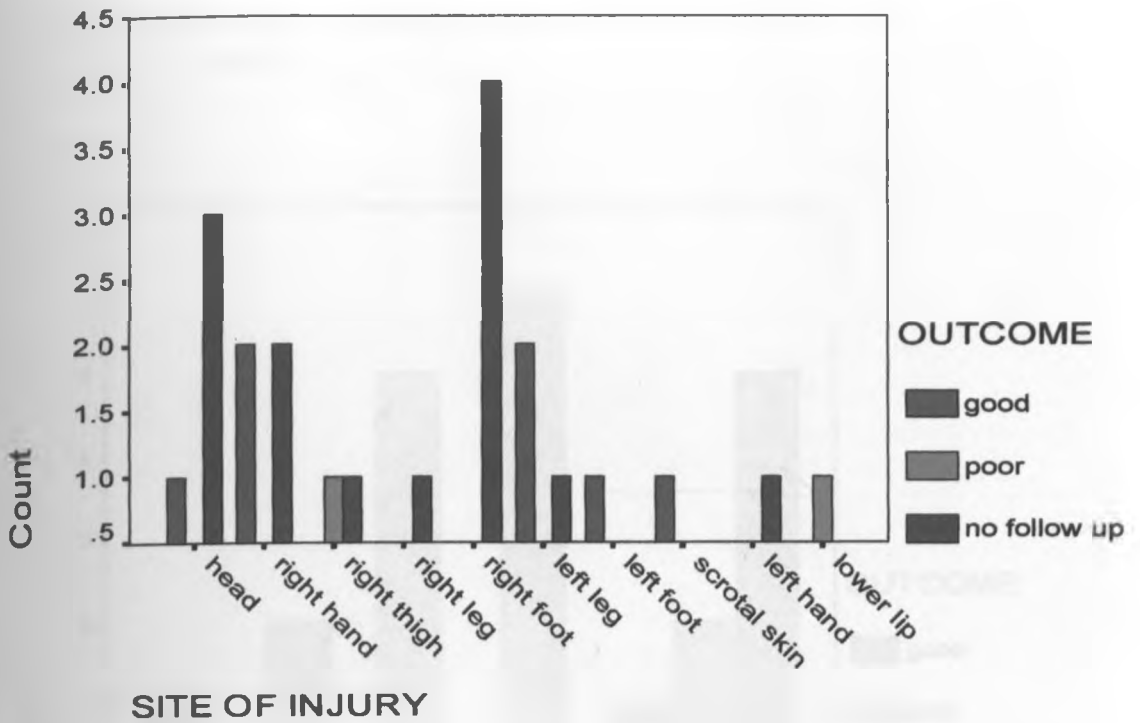
		OUTCOME			Total
		Good	poor	no follow up	
SEX	Male	6	1	12	19
	female	1	1	1	3
Total		7	2	13	22

The time spent in casualty varied from less than one hour to more than six hours. Nine patients spent less than one hour in casualty, of these three had good outcomes, while six did not attend follow up clinics. Seven patients spent between one and two hours in casualty, two having a good outcomes, five not returning for follow up. Three patients spent between two and three hours in casualty after diagnosis, one having a good outcome while two did not return for follow up. Three patients spent more than six hours in casualty with one having good results and two having poor outcomes.



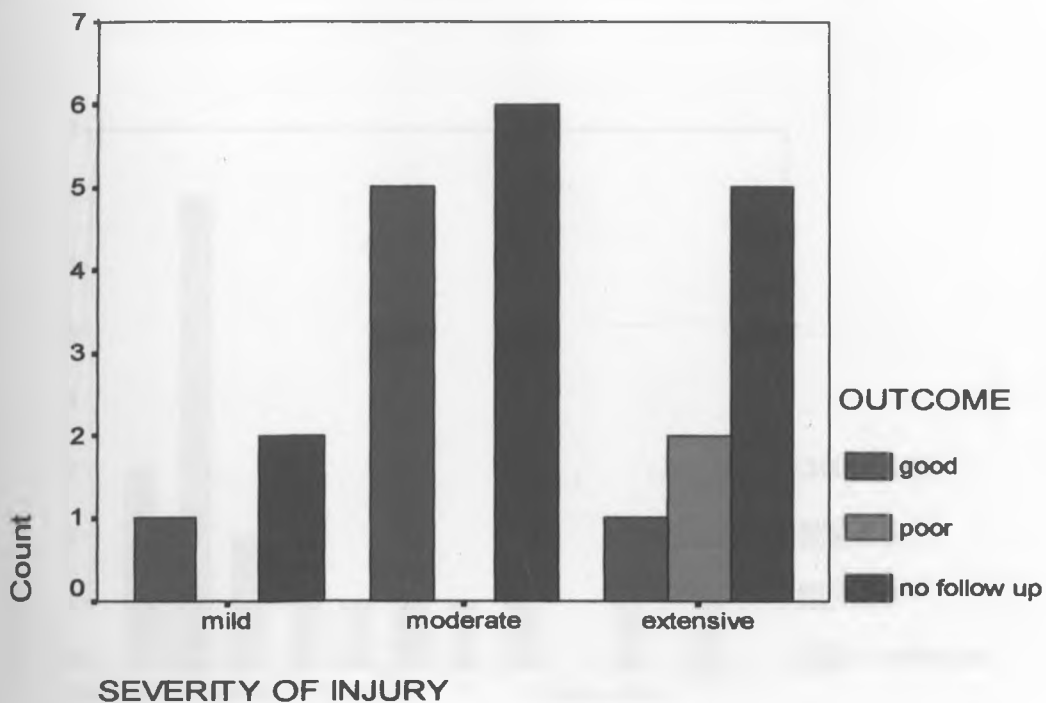
		OUTCOME			Total
		GOOD	POOR	no follow up	
DURATION IN CASUALTY	<1 hr	3		6	9
	1 to 2 hrs	2		5	7
	2 to 3 hrs	1		2	3
	>6 hrs	1	2		3
Total		7	2	13	22

There was a fairly wide distribution of injuries around the body with four having injuries involving the scalp and head, one had a good outcome, while the other three did not return for follow up. Four sustained injuries to their right hands, two having good outcomes, while the other two did not attend the follow up clinics. Two injured their right thighs one had a poor outcome while the other did not attend the follow up clinics. One injured his right leg, but did not return for follow up. Four injured their right foot and on discharge they disappeared, not returning for follow up. Three injured their left leg with two having good results on discharge, while one did not return for follow up. One injured his left foot but had a good outcome. Scrotal skin was avulsed in one with good outcome. The left hand was injured in one patient, who did not return for follow up. The lower lip was avulsed in one patient with poor results after repair.



SITE OF INJURY	OUTCOME			Total
	GOOD	POOR	no follow up	
Head	1		3	4
Right hand	2		2	4
Right thigh		1	1	2
Right leg			1	1
Right foot			4	4
Left leg	2		1	3
Left foot	1			1
Scrotal skin	1			1
Left hand			1	1
Lower lip		1		1
<b>Total</b>	<b>7</b>	<b>2</b>	<b>13</b>	<b>22</b>

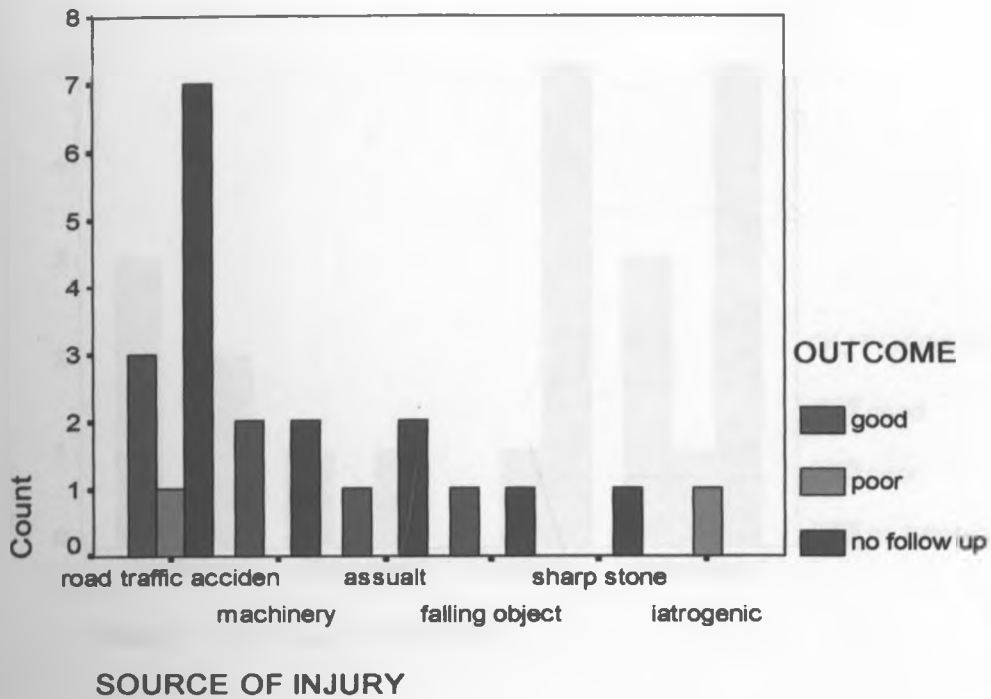
Three patients had their injuries classified as mild two did not attend follow up clinics after discharge, while one had a good outcome. Eleven patients were considered to have injuries of moderate severity, six did not return for follow up, while five had good outcomes. Eight had extensive injuries, five did not return for follow up while two had poor outcomes and one had a good outcome.



		OUTCOME			Total
		GOOD	POOR	no follow up	
SEVERITY OF INJURY	Mild	1		2	3
	Moderate	5		6	11
	Extensive	1	2	5	8
Total		7	2	13	22

Road traffic accidents were the leading cause of degloving injuries accounting for injury in eleven patients, of these seven did not return for follow up after discharge from hospital, three had good results and one had poor results. Four were injured by machinery two with good outcomes and two had no follow up. Three patients sustained avulsion injuries secondary to assault, one having a good outcome after repair while two did not appear for follow up. Falling objects injured two patients one having a good outcome after repair while the other did not attend the

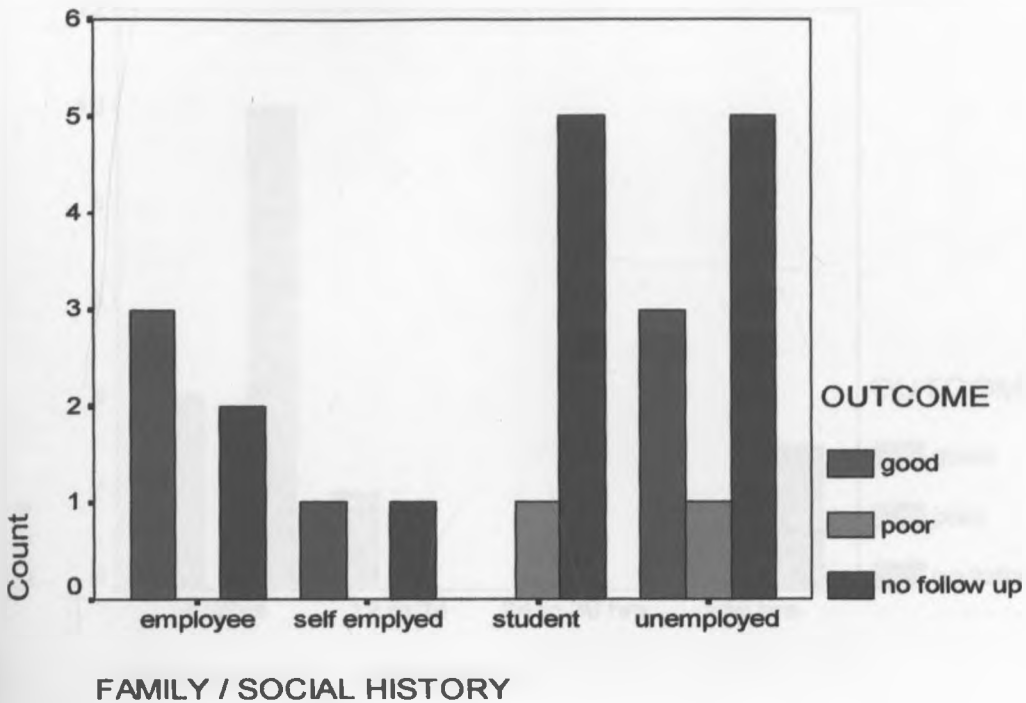
follow up clinics. A sharp stone injured one patient, after discharge he did not return for follow up. Iatrogenic injury occurred in one case, with poor results after attempted repair.



	OUTCOME			Total
	GOOD	POOR	no follow up	
road traffic accident	3	1	7	11
machinery	2	0	2	4
assault	1	0	2	3
falling object	1	0	1	2
sharp stone	0	0	1	1
iatrogenic	0	1	0	1
	7	2	13	22

On the socio-economic side, those employed either in the private or public sector had five patients, two did not attend the follow up clinics, while three had good outcomes. Two patients were self-employed, one having a good outcome while one did not return for follow up. Six of the patients were students five did not return for

follow up while one had a poor outcome. Nine patients were unemployed, five did not return for follow up three having good outcomes, while one had a poor outcome.

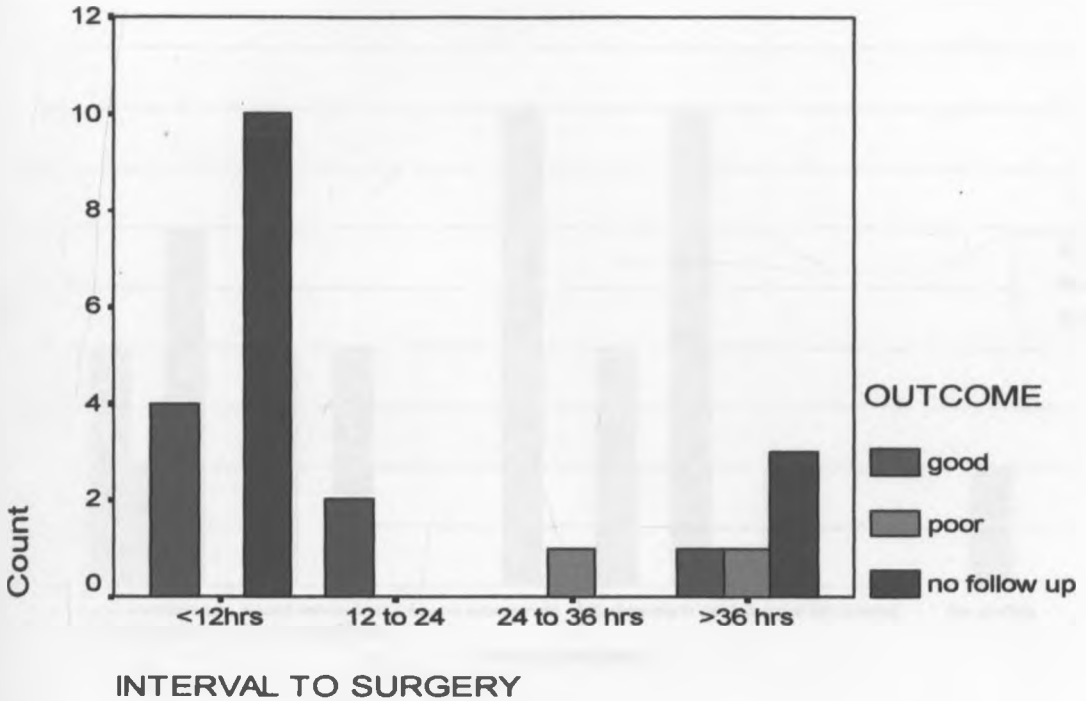


**FAMILY AND SOCIAL HISTORY**

	OUTCOME			Total
	GOOD	POOR	no follow up	
Employee	3		2	5
self employed	1		1	2
Student		1	5	6
Unemployed	3	1	5	9
	<b>7</b>	<b>2</b>	<b>13</b>	<b>22</b>

The time interval spent in the ward awaiting surgery varied from less than twelve hours to more than thirty six hours, with the longest having been seventy two hours. Fourteen patients spent less than twelve hrs before surgery, four eventually had good outcomes, ten did not return for follow up. Two waited between twelve and twenty four hours, with good results. One patient spent between twenty-four and

thirty six hours before the initial surgery outcome was poor. Five patients spent greater than thirty-six hours in the ward before surgery, three did not return for follow up, one had a good outcome while the other had poor results.

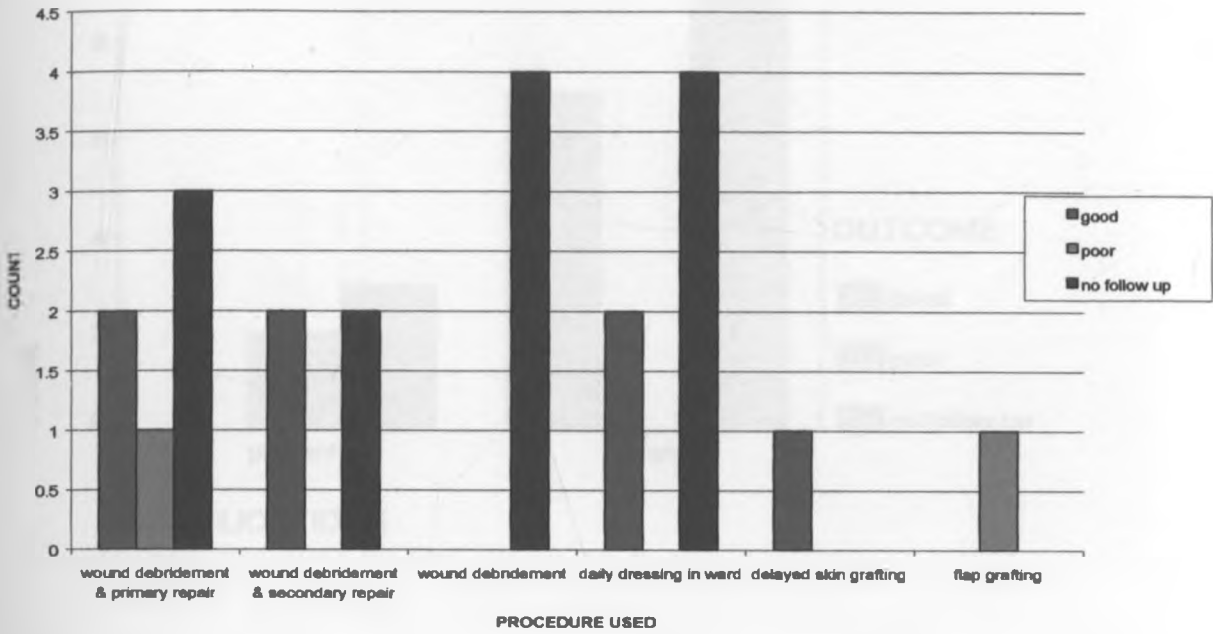


INTERVAL TO SURGERY	OUTCOME			Total
	GOOD	POOR	no follow up	
<12hrs	4		10	14
12 to 24	2			2
24 to 36 hrs		1		1
>36 hrs	1	1	3	5
<b>Total</b>	<b>7</b>	<b>2</b>	<b>13</b>	<b>22</b>

The initial procedure used was wound debridement and primary repair in six patients, two having good outcomes, one having poor results while three did not appear for follow up. Wound debridement and secondary repair was used in four patients, two having good outcomes, while two did not appear for follow up. Wound debridement alone was used in four patients, after discharge, they did not return for follow up. Six

underwent daily dressing in the ward two with good results, while four did not return for follow up. Primary skin grafting was carried out on one patient with good results.

A myocutaneous flap was used in one patient with poor results.

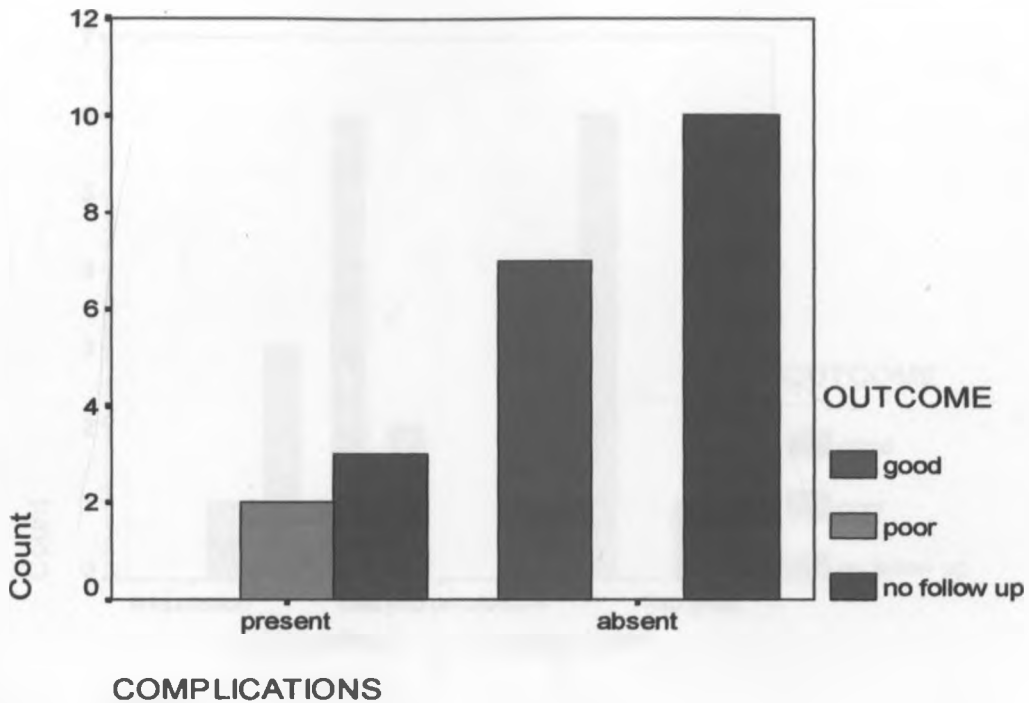


PROCEDURE USED	OUTCOME			Total
	GOOD	POOR	no follow up	
wound debridement & primary repair	2	1	3	6
wound debridement & secondary repair	2	0	2	4
wound debridement	0	0	4	4
daily dressing in ward	2	0	4	6
delayed skin grafting	1	0	0	1
flap grafting	0	1	0	1
<b>Total</b>	<b>7</b>	<b>2</b>	<b>13</b>	<b>22</b>

Of the twenty-two patients five had complications, mostly in the form of wound sepsis. Of these, two subsequently had poor results, while three did not attend follow up clinics.

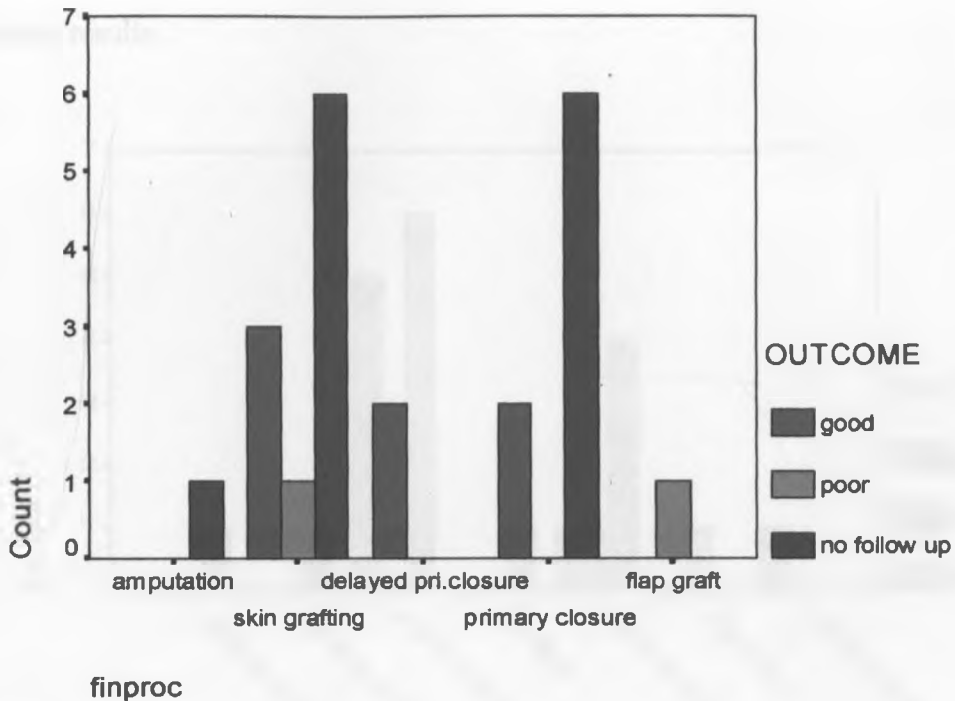
Seventeen had no complications, seven with good outcomes, ten did not appear for follow up.





COMPLICATIONS	OUTCOME			Total
	GOOD	POOR	no follow up	
present	2	3	0	5
absent	7	10	0	17
<b>Total</b>	<b>7</b>	<b>2</b>	<b>13</b>	<b>22</b>

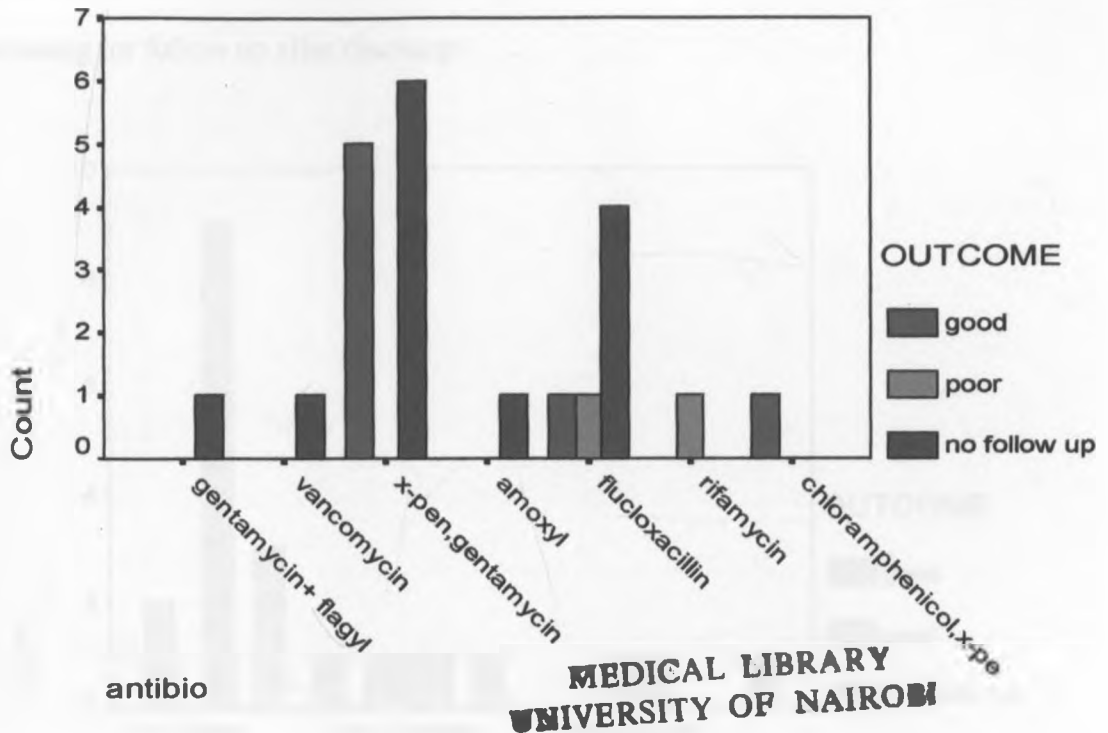
As the final management, one patient required amputation of the affected limb, he did not return for follow up. Skin grafting was carried out in ten patients with good results obtained in three patients, one patient having poor results, six did not return for follow up. Delayed primary closure was used in two patients with good results. Primary closure was carried out in eight patients, six did not attend the follow up clinics, and the other two had good results. A pedicled myocutaneous flap was used in one patient with poor results.



Final procedure	OUTCOME			Total
	GOOD	POOR	no follow up	
Amputation			1	1
Skin grafting	3	1	6	10
Delayed pri.closure	2			2
Primary closure	2		6	8
Flap graft		1		1
<b>Total</b>	<b>7</b>	<b>2</b>	<b>13</b>	<b>22</b>

Gentamycin and flagyl was used in combination in one patient, who did not return for follow up. Vancomycin was also used in one patient who also did not reappear for follow up. X-pen and gentamycin as a combination was used in eleven patients, with good results in five, six though discharged successfully did not reappear for follow up. Amoxyl was used in one patient. Flucloxacillin was used in six patients, one had a poor outcome, one did well, and four were discharged but did not return for follow up. Rifampicin was used in one patient but results were poor.

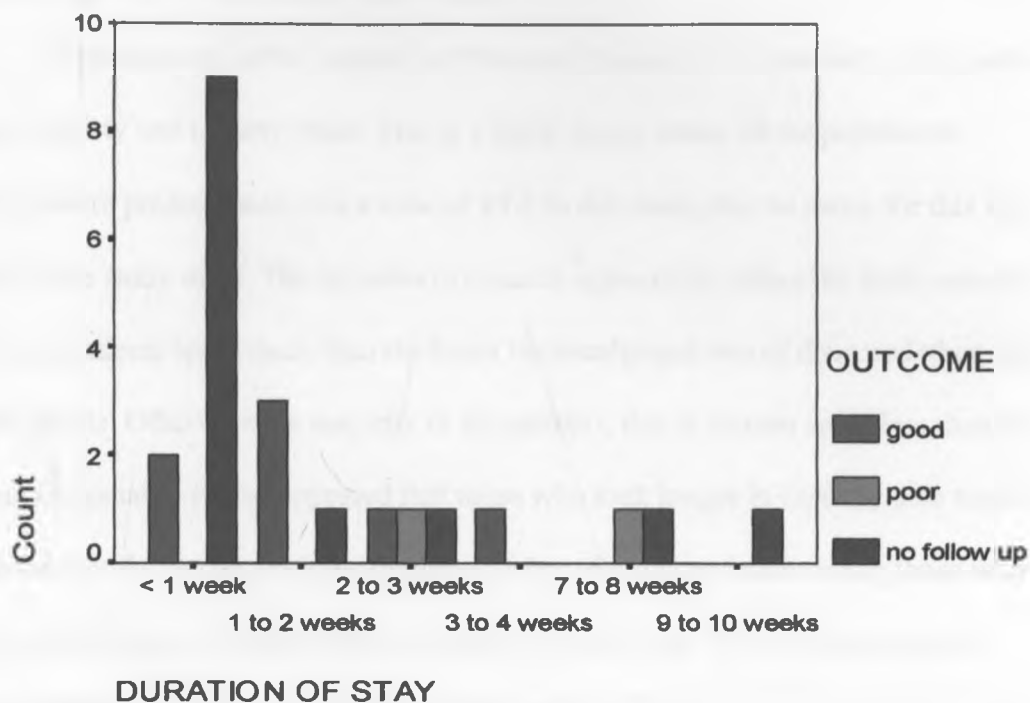
Chloramphenicol and X-pen as a combination was used in one patient with scalp avulsion with good results. These were however not based on any culture and sensitivity results.



		OUTCOME			Total
		GOOD	POOR	no follow up	
antibio	gentamycin+ flagyl			1	1
	Vancomycin			1	1
	x-pen, gentamycin	5		6	11
	Amoxyl			1	1
	Flucloxacillin	1	1	4	6
	Rifamycin		1		1
	chloramphenicol, x-pen	1			1
<b>Total</b>		<b>7</b>	<b>2</b>	<b>13</b>	<b>22</b>

The duration of stay in the hospital from the time of admission in casualty to the time of discharge in weeks ranged from less than one week in eleven patients to ten weeks. For those who stayed for less than one week, two had good results, while nine did not attend follow up clinics. Four patients spent between one to two weeks in the ward, three having good results, one not appear for the follow clinics. Three

stayed for between two to three weeks one having good results, one having a poor outcome and one not returning for follow up. One stayed for three to four weeks with good outcome. Two stayed for seven to eight weeks with one having poor results while the other did not return for follow up. One stayed for about nine to ten weeks not returning for follow up after discharge.



DURATION OF STAY	OUTCOME			Total
	GOOD	POOR	no follow up	
< 1 week	2		9	11
1 to 2 weeks	3		1	4
2 to 3 weeks	1	1	1	3
3 to 4 weeks	1			1
7 to 8 weeks		1	1	2
9 to 10 weeks			1	1
<b>Total</b>	<b>7</b>	<b>2</b>	<b>13</b>	<b>22</b>

Follow up was poor, thirteen patients not attending the clinics. Of those who attended, seven had good results while two had poor results. Among those with poor results one was an iatrogenic resection of the lower lip and still none of the attempts

at refashioning for her a lower lip had proved successful at the time of closing the study. The other was a young 8-year-old boy who had extensive degloving injury to his right thigh. The limb had healed with contracture at the back of the knee and at the time of closing the study he was being scheduled for release of contracture.

## **DISCUSSIONS AND CONCLUSIONS:**

The majority of the patients fell between the ages of one to forty years, with a peak at thirty one to forty years. This is a fairly young sector of the population

Males were predominant with a ratio of 19:3 in this study, but no cause for this was seen in the study itself. The duration in casualty appeared to affect the final outcome, as three patients spent more than six hours in casualty and two of them ended up with poor results. Otherwise the majority of the patients, that is sixteen spent less than two hours in casualty. It also appeared that those who took longer in casualty also tended to return for follow up, with the highest number of clinic attendees being those who took greater than six hours between casualty and the ward. The lowest number of those returning for follow up took less than one hour.

The distribution of the injuries was widespread with no predominance in any particular region. Outcome did not appear to be affected by region injured. The majority of the injuries were of moderate severity, with about half of the patients involved in the study. There were no recorded poor results in this group. Those who had extensive injuries did have poor results, and so it appears that the severity of the injury does affect the outcome.

Road traffic accidents appeared to be the leading cause of degloving injuries, being the cause in eleven patients. The study showed that nine of the patients were unemployed. Those who were self-employed had the lowest number of patients with

only two. Students had the lowest number returning for follow up, only one out of six, who possibly attended due to the poor outcome. The interval to surgery was generally good with fourteen patients being taken to theatre in less than twelve hours, however ten of them did not return for follow up, there were no recorded poor outcomes.

Those who stayed longest before surgery did have recorded cases with poor outcomes without of the six patients spent greater than twenty-four hours, two finally ended up with poor results. A larger study would need to be carried out to determine the cause. The procedure used varied from wound debridement and primary repair, to grafting with a myocutaneous flap and of the twenty-two patients only two had poor results. It therefore appears that on most occasions the method decided upon was good.

Complications were few, with only five recorded cases. All of these were secondary to wound sepsis. Only one patient ended up losing his right leg due to a total degloving injury of his right thigh. An attempt had been made at primary closure using the skin flap, but this underwent necrosis, resulting in the decision to amputate the limb.

Eleven patients were started on intravenous penicillin and gentamycin. From the authors experience this is the most available antibiotic combination in the hospital. The results were good with no recorded poor outcomes in this group. The antibiotics were prescribed on a best guess basis as Pus Swabs were taken in only four patients.

The longest duration of stay was about ten weeks, but the majority stayed for less than one week. This however Alsip included those who were discharged after twenty-four hours. It appeared that those who were discharged earlier had good results, but it must be remembered that their wounds would tend to be less severe, and their return for follow up was also poor.

## **RECOMMENDATIONS:**

The study appears to suggest that reducing the time spent between trauma and the initial operative management reduced the number of poor outcomes. This indicates that attempts to reduce the time spent on diagnosing, stabilising and finally getting the patient to the theatre would probably improve the outcome especially in those patients with severe injuries.

It would be good if all patients with degloving injuries had Pus Swabs taken before antibiotics were started, this would assist in identifying which organisms are present at the site of injury and which antibiotics they were sensitive to.

The study showed that attendance at the follow up clinics was very poor. Attempts could be made to make it easier for the patients to attend the clinics by, either moving the clinics nearer through the use of outreach programmes or patients could be encouraged to attend follow up clinics at their local health facilities. The facilities could then either send back reports, or refer those patients with complications for further management.

**PHOTOGRAPHS:**



**FIGURE 1:**

Extensive skin and subcutaneous tissue avulsion on the dorsum of the right hand of a lady, following assault by her husband using a machete “panga”. Surgical toileting has been done with wound debridement.





**FIGURE 2:**

Degloving injury to the dorsum of the right hand, this is starting to heal by secondary intention, there is good granulation tissue, and the wound is ready for grafting. Approximating the skin after undermining it could also close this wound.



**FIGURE 3:**

**Skin and subcutaneous tissue avulsion in a man who had his right thigh caught between the tyre and the mudguard of a motor vehicle. Initially a large flap was hanging down, an attempt was made at primary repair on arrival. The flap underwent necrosis and had to be excised, leaving him with an extensive degloved area extending from the hip to the knee, circumference in nature. After about three weeks of conservative management, it was decided that it was better to amputate the limb. Note the visible muscles and neuro-vascular bundles.**



**FIGURE 4:**  
The same lady as in figure 1, after skin grafting



**FIGURES 5, 6 & 7:**

The Photographs are to show how avulsions of the lower lip can be repaired. This is a common injury after bar room brawls, when one individual bites of the lower lip of his/her colleague. In this case the lower lip avulsion was iatrogenic, having been excised due to squamos cell carcinoma involving the lower lip. A delto-pectoral flap was made, as in figure 6, sutured to the margins of the wound to create a lower lip, figure 7. After 14 to 21 days, the flap is detached from the chest and a new lip is fashioned.



**FIGURE 8:**

Circumferential avulsion injury on the right leg of a young lady who was run over by a vehicle. The skin graft took well, but the final appearance of the leg was disappointing, according to the patient's statement, "I shall never be able to wear a skirt again."

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## APPENDIX:

### QUESTIONNAIRE;

- Name.
- Age
- Sex
- IP No.
- Past Medical History
- Family & Social History.
- General Examination.
- Other Systems
- Local Examinations
- Date and time of injury
- Date and time of admission
  - At Casualty
  - At the ward
- Initial surgical management
  - Date and time of surgical toileting.
  - Findings at surgical toileting.
  - Procedure used.
- Subsequent post-operative management.
  - What was done?
  - Results of culture and sensitivity.
  - Antibiotics used.
- Complications.
- Date of discharge from the ward
- Follow-up in clinic
- Current status & outcomes.

The end

PATIENT ID	AGE	SEX	DURATION IN CASUALTY
1	31 to 40yrs	male	2 to 3hrs
2	<1yr	male	1 to 2 hrs
3	<1yr	male	1 to 2 hrs
4	31 to 40yrs	male	<1hr
5	31 to 40 yrs	male	<1hr
6	31 to 40 yrs	male	<1hr
7	1 to 10 yrs	male	1 to 2 hrs
8	21 to 30 yrs	female	< 1hr
9	21 to 30yrs	male	<1hr
10	31 to 40yrs	male	2 to 3 hrs
11	31 to 40yrs	male	>6hrs
12	1 to 10 yrs	female	<1hr
13	11 to 20yrs	male	<1hr
14	1 to 10 yrs	male	1 to 2hrs
15	11 to 20 yrs	male	<1hr
16	21 to 30 yrs	male	1 to 2 hrs
17	31 to 40 yrs	male	2 to 3 hrs
18	11 to 20 yrs	male	<1hr
19	21 to 30 yrs	male	1 to 2 hrs
20	51 to 60 yrs	male	1 to 2 hrs
21	61 to 70yrs	female	>6hrs
22	1 to 10 yrs	male	>6hrs

SITE OF INJURY	SEVERITY OF INJURY	SOURCE OF INJURY
right thigh	extensive	road traffic
head	extensive	road traffic
left leg	moderate	falling object
right hand	moderate	machinery
right hand	moderate	machinery
left leg	moderate	road traffic
head	moderate	assault
left leg	moderate	road traffic
head	moderate	assault
right hand	mild	machinery
head	extensive	road traffic
right foot	mild	road traffic
left foot	moderate	road traffic
right foot	moderate	falling object
right hand	moderate	sharp stone
right foot	extensive	road traffic
left hand	mild	machinery
right foot	extensive	road traffic
right leg	extensive	road traffic
scrotal skin	moderate	assault
lower lip	extensive	iatrogenic
right thigh	extensive	road traffic

FAMILY AND SOCIAL HISTORY	INTERVAL TO SURGERY	PROCEDURE USED
student	>36hrs	wound debridement
unemployed	>36 hrs	wound debridement
unemployed	12 to 24 hrs	wound debridement &
employee	<12hrs	daily dressing
employee	<12hrs	daily dressing
unemployed	<12hrs	wound debridement &
unemployed	<12hrs	wound debridement &
employee	<12hrs	wound debridement &
self-employed	<12hrs	daily dressing
employee	<12hrs	daily dressing
unemployed	12 to 24hrs	wound debridement &
student	<12hrs	daily dressing
unemployed	>36hrs	delayed skin grafting
student	<12hrs	wound debridement
student	>36 hrs	wound debridement &
unemployed	<12 hrs	daily dressing
employee	<12 hrs	wound debridement,
student	<12hrs	wound debridement &
unemployed	<12 hrs	wound debridement &
self employed	< 12 hrs	wound debridement &
unemployed	>36hrs	flap grafting
student	24 to 36 hrs	wound debridement &

COMPLICATIONS	PUS SWAB	SENSITIVITY	FINAL PROCEDURE	ANTIBIOTICS
present	E. Coli, Staph.	amoxyl + Flucl	amputation	gentamycin + fl
present	pseudomonas	gentamycin	skin grafting	vancomycin
absent	not done	not done	delayed pri. Closure	x-pen, gentam
absent	not done	not done	primary closure	x-pen, gentam
absent	not done	not one	primary closure	x-pen, gentam
absent	not done	not done	skin grafting	x-pen, gentam
absent	not done	not done	primary closure	x-pen, gentam
absent	not done	not done	skin grafting	x-pen, gentam
absent	not done	not done	primary closure	x-pen, gentam
absent	not done	not done	primary closure	x-pen, gentam
absent	not done	not done	skin grafting	chloramphenic
absent	not done	not done	primary closure	amoxyl
absent	not done	not done	skin grafting	flucloxacillin
absent	not done	not done	skin grafting	flucloxacillin
absent	not done	not done	primary closure	flucloxacillin
present	not done	not done	skin grafting	flucloxacillin
absent	not done	not done	primary closure	flucloxacillin
absent	not done	not done	skin grafting	x-pen, gentam
absent	not done	not done	skin grafting	x-pen, gentam
absent	not done	not done	delayed pri. Closure	x-pen, gentam
present	pseudomonas	rifamycin	flap graft	rifamycin
present	E. coli, Strep.	gentamycin, flu	skin grafting	flucloxacillin

**MEDICAL LIBRARY  
UNIVERSITY OF NAIROBI**



DURATION OF HOSPITAL STAY	OUTCOME
>2mths	no follow up
1 to 2 mths	no follow up
<1 week	good
1 to 2 mths	good
<1week	no follow up
< 1 week	no follow up
< 1week	no follow up
2 to 3 weeks	good
<1week	no follow up
<1 week	good
1 to 2 weeks	good
<1week	no follow up
1 to 2 weeks	good
1 to 2 weeks	no follow up
< 1week	no follow up
<1 week	no follow up
<1 week	no follow up
2 to 3 weeks	no follow up
< 1 week	no follow up
1 to 2 weeks	good
>2mths	poor
2 to 3 weeks	poor