CASUALTY WOUND INFECTION:

- A study of the role of prophylactic antibiotics in its prevention in stitched minor wounds.

BY

Dr Austin George Manasseh Mwale
M.B, B.S.;

A dissertation submitted in part fullfillment for the degree of :

Master of Medicine (Surgery) 1980

TABLE OF CONTENTS

DECLARATION

This dissertation is my original work and has not been presented for a degree in any other university.

DR. A.G.M. MWALE MB, B.S

Candidate:

This dissertation has been submitted for examination with my approval as University supervisor.

MR. I. KAKANDE - M. Med (Surgery)

S U P E R V I S O R

ACKNOWLEDGEMENTS

Although this dissertation is my original work, I would be failing in my duty if I do not mention all those who have helped me in various ways in its preparation and writing.

I am particularly grateful to Professor A.M. Odonga under whose supervision this dissertation was written; and Dr. I. Kakande for some very useful suggestions and for reading through the final draft, following the departure of Professor Odonga. I am also most grateful to Miss S.R.N. Waigwa for her assistance in all the bacteriological work in this study, Professor H. Nsanzumuhire of the department of Bacteriology, for some useful suggestions; Mrs. K. Songe for the loan of a typewriter, Miss L. Ndege and Mrs. T.S. Aloumasa for secretarial assistance.

Lastly but not least, I am indebted to the patients and the casualty staff without whose cooperation this dissertation would never have seen the light of day.

PREFACE

The Role of antibiotics in the treatment of established infection, is well known, and the methods are agreed upon. On the other hand, the role of prophylactic antibiotics still remains a point for arguement. Whereas recent research on the role of prophylactic antibiotics in surgical wound infection has resolved some of the arguements; the epidemiology of wound sepsis in casualty and out patients departments, has been studied to a lesser extent than the former.

Since tetanus toxoid and antitetanus serum have been shown to be potent weapons against tetanus, and therefore, where these are available, there appears to be little justification in adding antibiotics, to the prophylaxis regimen. The question that remains to be answered is whether antibiotic prophylaxis in stitched minor casualty wounds is of any value or not.

Taking into consideration that these form the largest single group of injuries that one treats in our casualty department, the cost of the drugs, the disposable syringes and needles, in this era of the "deminishing Drug Vote", can be quite c@ll@ssal. This study was designed to investigate the effect on sepsis rate in stitched minor casualty cuts and lacerations, of the commonly used antibiotics in our casualty department.

INTRODUCTION

Although wound sepsis, gangrene, erysipelas, and tetanus had long been recognised as the scourges of surgery and trauma, it was not until the latter half of the nineteenth century that the work of Louis Pasteur, and Robert Koch, established the microbiological aetiology of infection.

Their discovery was a belated confirmation of what Ignaz Semmelweis had long believed was the case. The development of the principles of modern surgery can be put in true perspective from the time of Lord Lister, whose introduction of antiseptic technics, following Pasteur's discovery, marked a turning point in the history and practice of surgery. Although his ideas met with scepticism and outright hostility from his contemporaries, there were some notable admirers, amongst whom was Professor Alexander Ogston of the University of Aberdeen who after observing the progress made by Lister in the control of postoperative wound sepsis, was prompted to burn the sign that hung over the entrance of his operating theatre, reading "Prepare to Meet thy God" a sad commentary on the state of Surgery at the time.

Further progress was made with the introduction of Aseptic technic by Bergman; his principles were based on the total exclusion of bacterial from the wound area and general cleanliness. From these the rituals of sterilisation and hand washing were born. Whilst these principles could be easily applied to elective surgical wounds, the same could not be applied to traumatic wounds, which at the time consisted mostly of combat wounds.

Not unexpectedly, major wars over the years have stimulated considerable interest in the bacteriology and management of traumatic war wounds. Thus during the first world war the word "debridement", was first introduced in the English medical literature (Hoover and Ivins 1959). Although over the years through overuse, it lost its original meaning, it is generally accepted that it means "Removal of all foreign material plus aseptic excision of all contaminated and devitalised tissue from a traumatic wound".

With the discovery of penicillin by Sir Alexander Fleming, in 1928, and its introduction in medical therapeutics by Florey and others in 1941 during the second world war, and also the introduction of Sulphur (Prontosil) by Domagk in 1935; It was hoped that surgical wound infection would at last be confined to the history books. And yet over one hundred years from the time of Lister and fifty years after the discovery of penicillin, surgical wound infection under the most ideal conditions still stands at 2% to 4% (Halasz 1977), and 7% to 20% in traumatic wounds (Caro and Surtees 1965).

Penicillin and other antibiotics discovered soon after came in vogue during the second world war as topical antibiotics. Their use initially met with tremendous success, but was short-lived as more and more resistant strains of bacterial emergeed, topical antibiotics rapidly fell into discrepute.

Over the years the use or abuse of antibiotics has been the subject of heated debates. Whereas the role of antibiotics in the treatment of established infection is not in dispute;

their role in the prophylaxis against infection has however been the subject of voluminous publications. The situation has not been helped much by the oft contradictory conclusions by various workers, in both experimental and prospective clinical studies.

Much research has been done on surgical wound infection and the role of antibiotics in its prevention, but comparatively little has been done in defining their role in traumatic wound infection, especially in minor trauma. This is inspite of the fact that it has been estimated that infection is five times more common in traumatic contaminated wounds than in surgical wounds. (Caro and Surtees 1965). The few studies that there are, have been inconclusive and oft contradictory.

Mendelson (1960) in an experimental study on goats subjected to injury by an explosive charge, found that animals treated with topical penicillin had a better survival than those treated with a mixture of topical neomycin and bacitracin. This was inspite of the fact that the latter combination had a wider antibacterial spectrum. The commonest infecting organism in this experiment was clostridium welchii, an organism notably sensitive to penicillin.. Since penicillin fell into disrepute as a topical agent, more and more attention has been turned to the widespectrum nephrotoxic and ototoxic group of antibiotics namely, bacitracin, neomycin, and polymyxin-B which are often sold in combination as a polyantibiotic spray.

Meleney (1956) recommended use of the polyantibiotic spray for clean selected cases, contaminated areas, accidental civilian wounds and compound fractures. Although the use of the polyantibiotic spray was based on sound bacteriological rationale, in actual practice the results were of mixed value. Gibson (1958) and more recently, Belzer et al 1973; Gilmore and Martin, (1974) found the polyantibiotic effective in reducing post operative wound infection, though in a subsequent study Gilmore et al found it not as effective as povidone iodine.

However, Caro and Reynolds (1967) in a prospective study on the use of this spray on stitched minor casualty wounds, found that it made no difference in the rate of sepsis.

The investigation of systemic prophylactic antibiotics has been largely confined to their role in the reduction of surgical wound infection. Whilst some generally acceptable absolute indications for prophylactic antibiotics have emerged, their general indications are still controversial, and the contradictory prospective studies have not made the situation any clearer.

Barnes, Pace, et al (1959) Rocha (1962) and numerous other studies have come to the conclusion that prophylactic antibiotics have no role on the prevention of surgical wound infection, and often, infected wounds harbour a strain of bacteria that is resistant to the prophylactic antibiotic used. Polk and Lopez-Mayer (1969) on the other hand, concluded that cephaloridine, used prophylactically did bring about a significant fall in surgical wound infection and that they did not encounter any emergence of resistant strains.

Since then there have been several favourable reports on the efficacy of cephaloridine, especially in colonic surgery. (Evans and Pollock (1973).

The role of prophylactic systemic antibiotics in traumatic wounds has been mainly investigated in combat wounds. Altimeier et al (1953) observed that, whilst prophylactic antibiotics did not prevent infection, they did prolong the "Golden period", and attenuated the subsequent infection when it did occur. In a war situation where surgical attention was liable to be delayed, their use was justified. Their observations were based on wounds they observed during the Korean conflict. Sanford et al (1957) Matsumato (1967) have subsequently confirmed these observations in simulated war wounds. Matsumato farther observed that the oxytetracycline, which he used for prophylaxis, gave better results when used locally than when given systemically.

However, Day (1975) in a prospective study on the role of systemic penicillin and tetracycline used as a local irrigant on stitched minor casualty wounds, found that contrary to expectations, the sepsis rate was actually higher (23%) for those who received antibiotics than those who did not (7%). His results were therefore at variance with the general common conclusions amongst the other workers referred to above.

At this Hospital an intramuscular injection of long acting penicillin (triplopen) and occassionally some other broadspectrum antibiotics are routinely given, immediately before surgical treatment of all accidental wounds seen in the casualty department. This is given at the same time with the first of the three dose Tetanus Toxoid immunisation schedule. The object is to prevent both infection and tetanus.

Although tetanus is a fairly common disease in this hospital a review of the hospital records for the period 1975-1979, of patients treated for casualty associated tetanus, (history and unequivocal clinical evidence of trauma), showed that there were approximately fifty such cases. Seven of whom had been seen and treated in our casualty department. All had sustained compound fractures with substantial contamination of the wound although they had received tatanus toxoid and triplopen, debridement was inadequate resulting in the development of the disease.

Smith (1963) and Smith et al (1964) proved both experimentally and clincally, the efficacy of tetanus toxoid in the prevention of tetanus. Lucas and Willis (1965) have shown the limitations of antibiotics in tetanus prophylaxis. Provided that debridement is meticulous there seems to be little danger in tetanus developing after tetanus toxoid, prophylaxis (Smith and Laurence) 1975. The study below was designed to ascertain the role of antibiotic prophylaxis in stitched minor casualty wounds in our situation, in view of the apparent negative conclusion by other workers, Caro and Reynolds, and Day, on their role.

MATERIALS AND METHODS

This study was conducted in the casualty department of the Kenyatta National Hospital. As the main non fee paying hospital in Nairobi, it draws its patients from practically every corner of the city.

Between the months of January and March 1979, and again in June/July the same year, patients who presented to the casualty department with fresh cuts or lacerations were accepted for the study in accordance with the protocol, details of which are given below. One should perhaps state from the outset that the cases followed up in this study represent only a small fraction of the cases that are seen and treated in our casualty in any given month. Only those who met the criteria of the protocol were accepted for the study have been considered in the final analysis.

The wounds included in this study were cuts and lacerations of at least three centimetres with no upper limit in length which after adequate debridement, where necessary, could be sutured primarily and the patient sent home on some form of treatment. The wounds had to be sufficiently minor for the procedure to be carried out under local infiltration analgesia, without causing undue pain or discomfort. All wounds had to be under six hours old i.e. within the Golden Period.

All patients received a dose of tetanus toxoid 0.5mls and 0.25mls for adults and children respectively. In accordance with the immunisation procedure, two more doses were given at one and two months after the first dose. Those who had been immunised before were given only a booster dose.

Wounds which were complicated by fractures, cut tendons, or were too extensive to be treated under local analgesia, or were complicated by abrasions in the vicinity of the cut, were not accepted for the study. Similarly patients who were referred from a primary health centre after being given an antibiotic were excluded from the study, as were any patients who subsequently required observation in the casualty recovery ward.

Upon acceptance for the study, a brief history was taken to establish the cause of the injury, and a special effort was made to establish the time since injury as accurately as possible. A general examination was then done to exclude other injuries not complained of. The type of dressing on the wound if any, and the haemostatic status of the wound were noted. The site, approximate size and presence of any contamination in the form street dirt were also noted. These details were recorded on a specially prepared form.

The patients were then randomly allocated to one of three treatment groups.

Patients of groups I received a dose of tetanus toxoid and some analgesics, these were the controls.

Patients of group II in addition to the above received a single intramuscular injection of long acting penicillin (Triplopen).

Patients of group III received the same as group I with the addition of a seven days course of tetracycline capsules given at 250mg six hourly.

Patients allocated to antibiotic prophylaxis had some wound swabs taken for culture of wound contaminants. The swab was taken by rubbing on the sides and depth of the wound before cleaning or administration of antibiotic. Swabs taken in the morning and early afternoon were taken directly to the bacteriology laboratory for direct smear examination and culture, in late afternoon. Swabs taken during the evening and night were kept in the refrigirator overnight and taken to the laboratory first thing in the morning. Swabs taken over the weekend were cultured directly onto culture plates and incubated in the routine laboratory incubator and taken for reading on Monday morning. All swabs were cultured aerobically on MacConkey Blood agar, no anaerobic cultures were done. Where a pathogen was grown sensitivity tests were carried out.

OPERATION DETAILS

All necessary surgery was carried out in the lone functional operating theatre in casualty. This is a room of approximately twenty five by twenty feet size with an attached sterilisation and anaesthetic rooms. There are no special ventilation facilities. It is important to mention at this stage that abscesses are routinely drained in the same theatre every afternoon with no special preparation between "clean" and septic cases other than physical removal of dirty equipment from the theatre and mopping of the floor with some antiseptic. Suturing was carried out with prepacked and presterilised instrument trays supplied by the central sterile supply department. Gowns and masks were worn all the time.

All procedures were carried out under 2% procaine hydrochloride without adrenaline, given by local infiltration. For the sake of uniformity all operative procedures referred to in this study were carried out by the author. Fiver percent hibitane solution was used for cleaning the wound and surrounding areas in most of the cases, and in a few cases 5% savlon solution was used, only when the former was not available in the hospital pharmacy. Under local infiltration a more thorough examination was carried out, with particular attention to the extent of contamination (if any) in the depth of the wound. In clean cuts after excluding physical contaminants, the depth and the surrounding areas were once again swabbed with the cleansing solution, any bleeders requiring ligation were ligated with 4/0 plain catgut.

In lacerated wounds, simple trimming of the wound edges was routinely done, to remove any devitalised tissue and achieve better approximation of the wound edges. Most of the wounds could be closed with a single layer of sutures. Where a two or more layer closure was necessary, plain catgut was used for the deeper layers and silk for the skin. The wound was then swabbed dry and dressed with a dry cellular gauze tissue.

REVIEW PROCEDURES

In the original protocol it was intended to review all patients on day three, five, and eight, at which a decision would be made on the removal of stitches. This proved to be impractical and it put a big strain on the financial resources of some of the patients who had to travel by bus for each visit, and a bit of a nuisance to most inspite of all efforts made to curtail their stay in casualty by having them come direct to the examination room where their records were kept.

To achieve maximum patient co-operation the routine had to be changed to a single review on day five for facial injuries and day seven for all other injuries. At review specific questions were asked to ascertain whether or not the patient had received additional treatment elsewhere. The wound was then examined, sutures removed and any infection noted. Infection in this study was defined as pus discharge from a sutured wound, mere induration was not consideration infection. Where possible a swab was taken for culture and sensitivity tests, and where necessary further dressings were carried out in the casualty dressing room. Healed wounds were discharged from follow up . All patients were reminded on discharge to come for their second and third doses of tetanus when these fell due.

RESULTS

Between January and March and again in June/July 1979, a total of one hundred and seventeen cases were admitted to the study. However only eighty-six cases are considered in the final analysis, the rest were either lost to follow up or were excluded for receiving additional treatment. Of the remainder, thirty-six were controls, twenty-six were in the penicillin group, and twenty four in the tetracycline group. Most of the injuries were situated in the head and neck area (Table I), the majority resulting from assault with either a rungu or panga. Injuries elsewhere on the body were mostly attributable to domestic or roadside trauma with a few exceptions, most of the victims were males, below fifty years age. Six patients or 16.7% in the control group were infected at the time of removal of stitches - Seven patients in the penicillin group 28.4% were infected at the time of removal of stitches; and four in the tetracycline group 16.6%. The overall infection rate in the treated group was 22% (11) compared with 16.7% (6) for the controls.

An attempt was made to analyse the factor that may be the determinants of infection. It is considered that the occassional use of savlon when hibitane was out of stock was a minor variable as only sixteen cases were swabbed with it.

INFLUENCE OF TIME SINCE INJURY

Forty-one patients from all groups were seen and treated in casualty within three hours from the time of wounding. This represents just under fifty percent of the total. These came within the "Effective Period" of antibiotic prophylaxis. There were six infected patients in this group, of which one had received tetracyline, two penicillin, and three were controls.

Forty-five patients were seen and treated after three hours but within six hours, there were eleven infected patients in this group, of which three had received tetracycline, five penicillin, and three were controls (Table II).

INFLUENCE OF SITE AND LENGTH OF WOUND

Influency of site and length of the majority of the wounds as shown in the table No. 1 were situated in the head and neck region mostly as a result. As the number of wounds elsewhere on the body were too few for a meaningful camparison, no useful conclusion could be arrived at taking the site of the wound as a variable, most of the wounds in the lower limbs were generally infected, and most of the wounds in the head and neck as expected healed by primary intuition to test the size of wound as a variable. The wounds were sub-grouped into three as indicated in table III again the figures were too few to be of stitistical significance.

BACTERIOLOGY

In the treated wounds, wound swabs were taken for culture and sensitivity studies, the aim being to obtain a sample of the bacterial flora that the antibiotics were expected to contend with the retrospectively determine whether the antibiotic used was justified or not.

In forty seven cases, the organisms cultured were those of normal skin flora namely staphylococcus albus, diphtheroids, and anthracoides, in two cases with wounds around the mouth

and face, streptococcus faecalis was grown; and in another a positive growth of acinetobacter was obtained. This was indentified only after extensive fermentation tests. Only one positive growth of staphylococcus aureus was obtained. All the pathogens grown were already resistant to the antibiotics used in this study.

Staphylococcus aureus on the other hand was grown from all the infected wounds which were cultured, and in one case escherichia coli was grown.

All were resistant to the antibiotics used in the study, and several other preparations (Table IV).

DISCUSSION

Miles (1957) in a study of early inflammatory change that occur in a bacterial lesion, observed that following innoculation of the organisms, there is an initial rise in capillary permiability, which reaches a peak at three hours thereafter rapidly declines to a constant level. This observation formed the basis for the theory of the "Effective Period" in antibiotic prophylaxis, (Miles, Miles, Burke et al 1960; Burke 1960). This was, for maximum efficacy, prophylactic antibiotics must be given during the period of maximum capillary permiability in order to reach adequate concentration levels in the wound fluid.

Linton (1961) in an editorial, took this concept further by suggesting that for antibiotics to be considered truely prophylactic, they must be actually present in circulation at the time of wounding. Burke (1961) showed in animal experiments that, penicillin given at various times before and after wounding was most effective in preventing infection if given before wounding, and that it had little or no effect if given after three hours. Altimeier (1960, Sanford et al (1957) conducted similar experiments and also came to a similar conclusion.

Given these results, one would wonder whether "Prophylactic" is an appropriate adjective for describing the use of antibiotics in a casualty situation.

The majority of the patients in the present study arrived in casualty for treatment long after the expiry of the "effective period" of antibiotic prophylaxis, but within the golden period for primary suturing. Most studies on casualty are in agreement that at least 5-20% stitched minor casualty wounds become infected, even after thorough debridement. (Buchanan et al 1969; Caro and Surtees 1965; Hllpike et al 1962). The actual development of infection in any given wound is influenced by the presence or absence of a number of predisposing factors. For example the time lag between injury and receipt of definitive treatment, location and extent of the wound, presence or absence of foreign bodies, virulence of the contaminating bacteria and the general condition of the patient.

In the present study the overall infection rate for the treated groups was 22% compared with the 16.7% for the control. There was a 16.6% infection rate in the tetracycline group and 28.4% in the penicillin group. Although the figures involved in this study are somewhat less than those of Day; Hutton and Jones (1978) and those of Caro and Reynolds, the results are in agreement with those of Day (1974) although in his study the tetracycline was administered by local wound irrigation, and the infection rate was higher for this particular group.

There is no easy explaination for this somewhat paradoxical results. Alexander (1975) in a panel discussion, stated that studies he had conducted on the serum/wound fluid equilibration rate of various antibiotics, revealed that penicillin

reached equilibrium rapidly and at one hour, wound fluid levels exceeded serum levels, tetracycline also reached peak concentration at one hour but wound fluid concentrations never exceeded serum levels. All the antibiotics in this particular study were given by a single intravenous injection.

One would therefore logically conclude from the above that intramuscular penicillin would equilibrate faster than oral tetracycline and on the other hand tetracycline administered by local irrigation would be expected to achieve a higher local concentration than intramuscular penicillin. Whereas one's aim when giving an antibiotic to treat a local infection is to achieve the highest possible concentration at the affected site, the results of the two studies Day's and the present one are somewhat paradoxical, in that where this ideal was achieved the rate of infection was higher! Though no attempt was made to calculate the exact time, it is estimated that the patients in this study who were on tetracycline probably had their first dose of the drug some two hours from the time it was prescribed, and therefore in terms of the "effective period" of Miles, probably reached the local site after the period of maximum permiability, somewhat late to make any difference in the local situation, hence the similarity of results with the controls.

Williams and Miles (1949 proposed that the word

"Contamination be used to describe presence of pathogenic bacteria in wounds of less than eight hours age, and that a wound more than eight hours yielding pathogenic bacterial be deemed infected. In this study, wound swabs for culture of wound contaminants were taken from the patients given antibiotic Prophylaxis; and none were taken from the controls. Whilst this study could be criticised from this point, it was considered that, upto the time of group allocation, the wounds were essentially the same and taking the swabs only from the treated groups would serve two purposes:
(a) It would provide a representative sample of the bacterial flora that one should expect in this type of wounds, and
(b) would give a retrospective justification (or lack of it) for the antibiotic used.

The commonest organisms isolated were the skin commensals, namely Staphylococcus albus, diphtheroids, and anthracoides. In some cases no growth was obtained. Only 5.8% of the wounds cultured yielded pathogenic bacteria, and were the only ones contaminated in terms of Williams and Miles proposal.

Hallpike et al (1962) have isolated a similar type of bacterial spectrum. None of the skin commensals have so far been amplicated in the etiology of superficial suppuration in our situation although Hutton and Jones (1978) implicated staph albus in two of their cases.

Sleigh and Price (1972) controlled resistant infection in an intensive care unit by simply discontinuing use of all antibiotics in the unit. They retrospectively suggested that the extensive use of antibiotics had created a vicious circle by altering the ecological balance, through elimination of

sensitive strains of bacteria, therefore discontinuation of the antibiotics allowed the ecological equilibrium to be restored. This arguement could in part be used to explain the higher sepsis rate amongst the treated through alteration of the local ecological balance in the wound. The normal skin bacterial are still largely sensitive to the commonly used antibiotics. Whilst this arguement may appear to be a plausible explaination in this situation it may not hold true elsewhere.

No evidence could be adduced from this study to suggest that use of the same theatre for "clean" and septic procedures could have been a factory in the sepsis rate. Buchanan et al (1961) in their detailed bacteriological studies of casualty wound sepsis in relation to the use of a common theatre for all procedures, found no evidence of association; Auto-infection from the nasal passages was more common.

Caro and Reynolds (1967 found no significant difference in the rate of sepsis when considering the length of the wound as a variable. In this study this was significant in that infection irrespective of the antibiotic used, increased with the size of the wound. This in part could be explained on the basis of a more limited excision one has to make on large wound, and therefore the more chances of leaving some contused tissue of margical viability.

CONCLUSION

Prophylaxis as defined by Linton cannot be applicable to casualty traumatic wounds. The majority of the patients in this study presented themselves for treatment well past the "Effective Period" of antibiotic prophylaxis, so that any antibiotic could not be expected to prevent infection; if anything their use in this study was associated with a higher than expected rate of sepsis. The bacteriology results showed that the commonest aerobic organisms present in wounds of less than six hours are none other than the skin commensals.

Lucas and Willis in their study showed the limited role of penicillin in the prophylaxis against tetanus; and that conclusion is confirmed by the seven cases who developed casualty associated tetanus after tetanus toxoid and penicillin prophylaxis in this hospital. Where a real danger of tetanus exists, the patient's interest would be well served by a simultaneous administration of antitetanus serum and tetanus toxoid as recommended by Smith and Laurence, with meticulous wound toilet. There is no doubt whatsoever that surgical excision and meticulous toilet in all traumatic wounds is the most important single factor in the prevention of wound infection.

It is the conclusion of this study that the commonly used antibiotics namely: Penicillin and tetracycline have very little role to play in the prophylexis against infection of stitched minor casualty wounds. The widespread use of antibiotics can lead to a false sense of security to the casualty staff and contribute to a fall in asceptic technics. As Hutton et al have observed with respect to the use of depot penicillin in casualty. "It seems to be given more as a result of tradition than for any logical reason". Thorough debridement and/or excision is the key to prevention of sepsis in stitched casualty wounds.

The role of Povidone iodine in this field has not yet been investigated; it may be a better alternative since unlike antibiotics, its use will not lead to development of resistant strains of bacteria.

TABLE I

Site	No. of cases	Infected	Healed
Head	34	7	51
Face	24		
Body	5	3	2
Upper limbs	9	Nil	9
Lower limbs	14	7	7

Site and distribution of infected wounds.

TABLE II

Time in hours	Controls	Penicillin	Tetracycline
3	16 (3)	13 (2)	12 (1)
>3 <6 but	20 (3)	13 (5)	12 (3)
Percent	16.7%	28.4%	16.6%

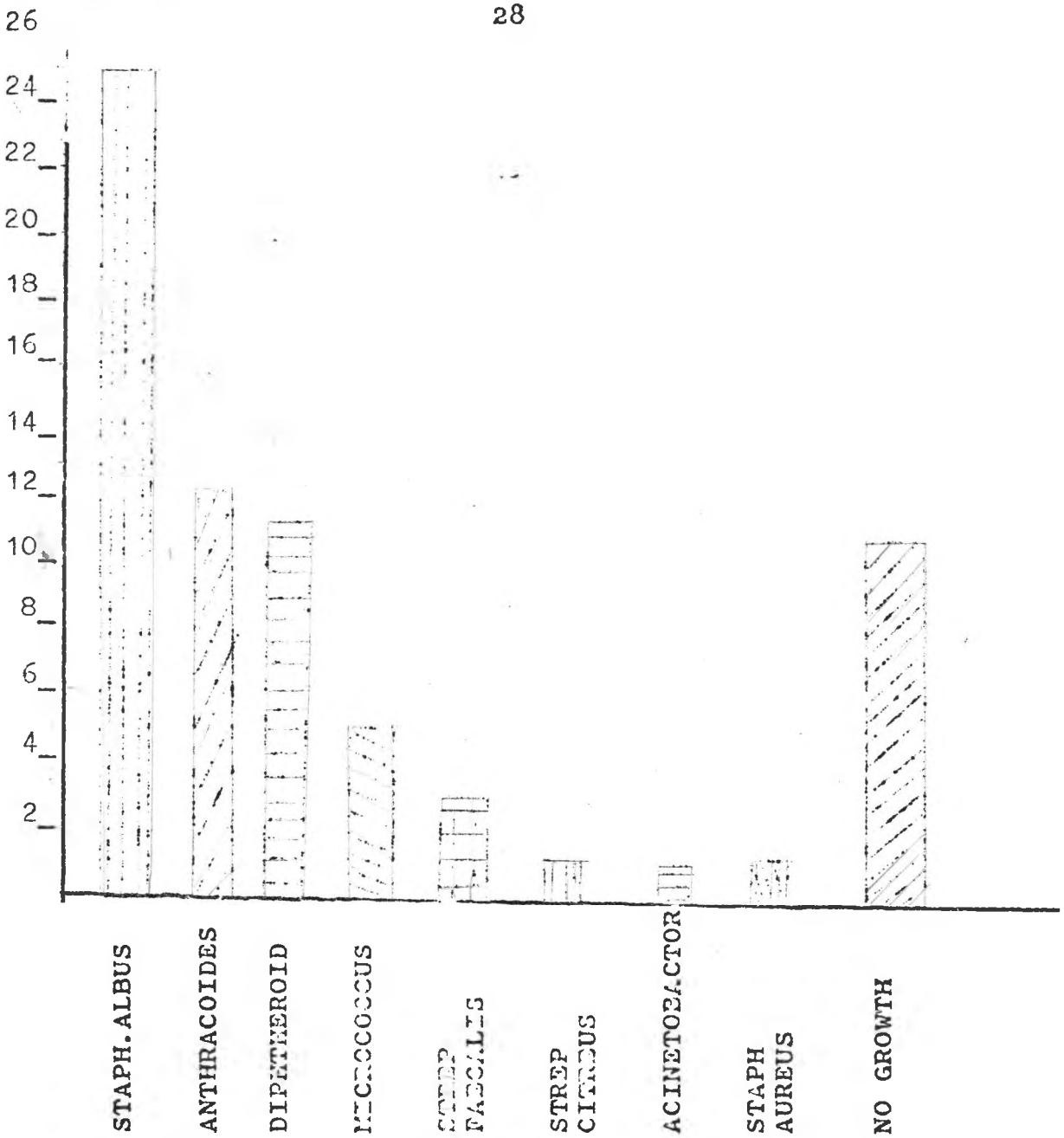
Time factor in wound sepsis.
(Figures in brackets indicate number of infected wounds).

TABLE III

Size in cms	Control	Penicillin	Tetracycline	Infected
3-5cms	10	10	8	3(10.7%)
6-8cms	23	13	12	10(22.7%)
9cms	3	3	4	4(30.7%)

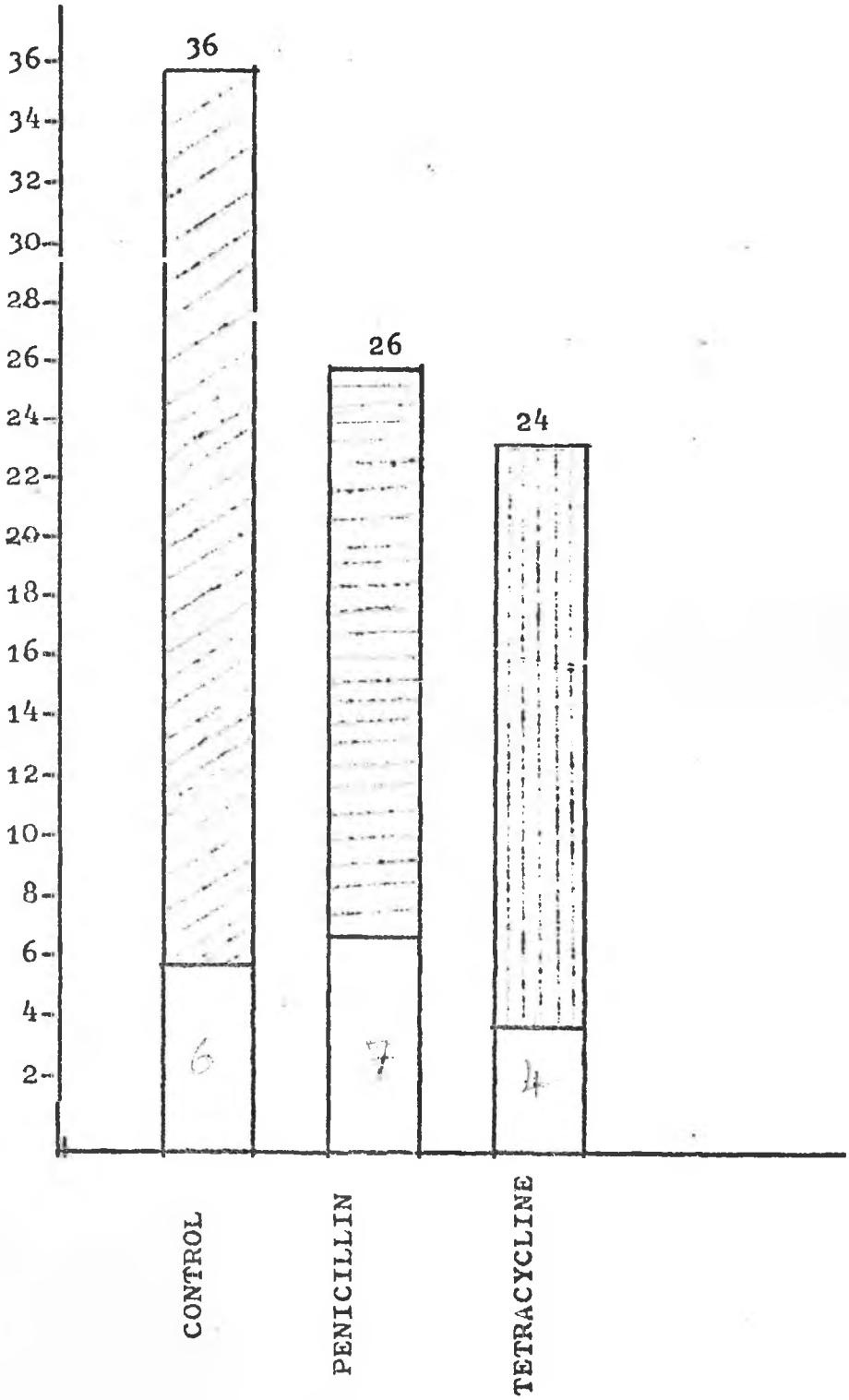
Table showing the influence of wound size on the rate of infection.

TABL.: IV



Histogram showing organisms cultured from fresh wound swabs. NB. In most cases cultures yielded mixed growths of more than three skin commensals.

TABLE V



Histogram showing rate of infection

REFERENCES

(1) Alexander, J.W.; McGloin, J.J.; Alteimeier, W.A;
Penicillin prophylaxis in experimental wound infection.
Surgical Forum 1960 vol II 299-300.

(2) Barnes, J.; Pace W.G.; and others.
Prophylactic post operative antibiotics.
Archieves of Surgery. 1959 vol 79 190-196.

(3) Belzer F.O.; Salvateirra, O.; Schweizer, R.T, Kuntz, S.L.;
Prevention of wound infection by Topical antibiotics
American Joural of surgery vol 126-180-1973

(4) Buchanann J. McK., Curwen M.P., Shooter, R.A.; White, R.G
Post operative infection in a Casualty department.
British Medical Journal 1961 1678-1680.

(5) Burke, J.F.;
Effective period of preventive antibiotic
action in experimental incisions and dermal lesions.
Surgery. 1961 vol 50 161-168.

(6) Burke J.F.;
Preoperative antibiotics.
Surgical Clinics of North America 1963 vol 43 665-676

(7) Caro, D.; Reynolds, K.W.;
An investigation to evaluate a topical antibiotic in the
Prevention of wound sepsis in a casualty department.
British Journal of Clinical Practice.
vol 21 No. 12 1967. 605-607.

(8) Caro, D.; Surtees S.J.;
British Journal of Clinical Practice vol 19, 131, 1965.

(9) Day, T.K.;
Controlled Trial of Prophylactic antibiotics
in minor wound requiring suturing
Lacet 1975 1174-1176.

(10) Gilmore, O.J.A.; Martin, T.D.M.;
Aetiology and Prevention of wound infection in Appendicetomy.
British Journal of Surgery 1974 vol 61 281-287.

(11) Gibson, R.M.;
Application of antibiotics using aerosol technic.
British Medical Journal I, 1326-1327.

(12) Hoover, N.W.; Irins, J.C.;
Wound Debridement.
American Archives of Surgery. vol 79 1959 701-709.

(13) Howe, C.W.;
Annals of Surgery
1957 146, 348.

(14) Hallpike, J.F.; McKeith, M.B.; Evans, D.I.K.;
The frequency of post operative infection in new
Casualty department.
Lancet, 1962, 754-755.

(15) Hutton, P.A.N., Jones, B.M., Law, J.W.
British Journal of Surgery
Vol 65 1978 - 549 - 550

(16) Linton, R.R.;
Prophylactic use of antibiotics.
Surgery, Obstetrics and Gynaecology. 1961, 218-220.

(17) Lucas, A.O.; Willis, A.J.P.;
Prevention of Tetanus.
British Medical Journal. 1965, 1333-1336.

(18) Meleney, J.F.;
The Present status of antibiotics.
Surgical Clinics of North America. 1956, vol 36 273-287.

(19) Miles, A.A.; Miles E.M.; Burke, J.;
British Journal of experimental Surgery 38, 79-96, 1957.

(20) Polk, H.C.; Lopez-Mayor, J.F.;
Post Operative wound infection,
A prospective study of determinant factors and prevention Surgery 1967, vol. 66 97-103.

(21) Rocha, H.;
Post operative wound infection: a controlled study of Antibiotic prophylaxis.
Archives of Surgery Vol. 85 1962 456.

(22) Sanford, J.P.; Evans, J.R.; et al.
Surgery Gynaecology and Obstetrics. 105: 5-15 1957.

(23) Sleigh, J.D.; Price, D.J.E.;
Lancet 1972, 1213-1215.

(24) Smith, J.W.G.;
Journal of Hygiene 1964 379.

(25) Smith, J.W.G.; Laurence, D.R.
British Medical Journal vol. 3 1975 453-455

(26) Smith J.W.G.; Evans D.G.; et al.
British Medical Journal Vol. 1 1963, 237-238.

(27) Alexander, J.W.;
Antibiotics in Surgery (Discussion)
Archives of Surgery, 11: 148, 1975.

(28) William Miles A.A.
Med. Res. Course. Sper Rep.
as quoted in Microbiology of Trauma by
John A. Washington II.

Appendix I

Photograph showing wound before excision.

Appendix II

Photograph showing wound after excision.

Appendix III

Photograph showing wound after suturing.