Original paper

Necrotizing Fasciitis: A deadly disease.

Cree, I.C., Phiri, P.S.
Department of Surgery, UTH, Lusaka, Zambia

Correspondence to: Prof. Cree I, P.O.Box 245, Barrington Passage, N.S. BOW 100, Canada.

Background: Knowledge of the diagnosis, cause, course and required treatment of this deadly disease among physicians and surgeons around the world is limited.
Methods: A study was undertaken at University Teaching Hospital (UTH), Lusaka Zambia to review the incidence, associated pathology, management given, and outcomes, comparing 2 sequential years. This study covered a transitional phase at the end of 2003 in which adequate surgical procedures and management of abscesses and Necrotizing Fasciitis (NF) were emphasized.
Results: A total of 126 patients had primary surgery, 81 in 2003 and 45 in 2004. There were 6 and 1 secondary operations respectively. The percentage of sloughectomy for NF increased from 66.7% in 2003 to 88.9 % in 2004 and incision and drainage dropped from 16% to 4.4%. The male to female sex ratio was 1.6 to 1. The disease primarily affected young patients with an average age 29 years 3 months in 2003 and 33 years 7 months in 2004. Seventeen (20.9%) of patients admitted in 2003 and 10 (22.2%) of those seen in 2004 died. Those patients who died were desperately ill on arrival and most were preterminal or moribund.
Conclusion: The marked reduction in cases in 2004 may have been due to better surgical care of abscesses and the increase in sloughectomy indicated better understanding of this vital operation. Total excision of all necrotic tissue can lower mortality further, but early access and diagnosis can have a profound effect on outcomes

Introduction

Necrotizing fasciitis (NF) was first described in 1848, but the term necrotizing fasciitis was first used in 1952 by Wilson. Notwithstanding the early description of this condition, many physicians and surgeons throughout the world are only vaguely aware of it, its clinical features, cause, course and the required treatment. Relatively uncommon in Europe, the USA and Canada[1], it is very common in Africa and often first seen only when it is in an advanced stage, at which point only very extensive surgery involving total removal of all necrotic tissue will save the patient[2].

In 1920 Meleney[3] in China described 20 cases of NF all of which were infected by hemolytic streptococci as the sole organism. The disease is a rapidly spreading necrosis of fascial and areolar tissues with extensive undermining of the skin and subsequent gangrene of the skin, caused by a mixed infection of aerobic, anaerobic and microaerophylic organisms, especially streptococci (hemolytic and microaerophilic) and staphylococci (usually haemolytic). Clostridia, especially C.perfringens (C.Welchii) are frequently involved as are peptostreptococci. Less common are haemophilus aphrophilus and phycomycetes.

Rapid spread of the infection, often in a matter of hours, is aided by:

- Thrombosis of venules and veins which creates an advancing anaerobic environment in which anaerobic bacteria thrive.
- Production of collagenase by the bacteria which destroys and liquefies fascia, thus breaking through all barriers.

Related conditions include:

- Synergistic gangrene caused by a mixed infection of anaerobic streptococci and staphylococci which causes extensive destruction of deep tissues.

- Cellulitis due to clostridial organisms, primarily Clostridium Perfringens (C. Welchii) which differs from clostridial myonecrosis (gas gangrene) insofar as it does not involve muscle.
- Non-clostridial gangrenous cellulitis caused by B. Melaninogenicus and anaerobic streptococci.
- Meleney's burrowing ulcer caused by a combination of microaerophilic streptococci and staphylococci.

In addition to collagenase and hyaluronidase, C. Welchii also produces potent toxins which are necrotizing and hemolytic, e.g. neuraminidase, and toxic lecithinases, e.g. phospholipase C. These enzymes have a deadly action on the local tissues but also enter the blood stream producing haemolysis and anaemia and systemic toxicity which can lead to obtundation, confusion, hallucinations and coma[4,5].

Advanced systemic toxicity results in septicemic shock with its sequelae of renal shutdown, ARDS, DIC, jaundice, severe irreversible hypotension, toxic effects on the myocardium and ultimate death. M1 and M3 surface proteins which increase adherence of streptococci and protect the streptococci against neutrophil phagocytosis and pyogenic exotoxin are considered to be virulence factors, while SSA (Streptococcal superantigens) lead to the release of cytokines by the body. These are well known autotoxins.

The course of NF can continue for as long as a week or more, but usually it is a matter of 24 to 48 hours before death ensues, especially if the patient arrives in the hospital late in the course of the disease. Immunosuppression and diabetes are well known antecedents to NF but a small or large wound, or an abscess, especially if inadequately drained, can develop rapidly into NF.

The disease is now classified as:

- NF Type I. Due to polymicrobial infection. Included under this heading is Saltwater NF in which wounds are infected with saltwater contaminated by Vibrio vulnificus.
- NF Type II. Due to group A Streptococci.
- NF Type III. Due to Clostridia. (Clostridial myositis or gas gangrene).

The condition can originate anywhere in the body, but perianal and ischiorectal abscesses are a common source, and the condition then spreads forward along the perineum to the scrotum, lower abdomen and upper thighs as well as outward into the buttocks. When the scrotum becomes involved, the condition is frequently misdiagnosed as Fournier's gangrene. Fournier's gangrene, strictly defined, is gangrene localized to the scrotum[7-11]. The mortality is of the order of at least 80%.

The American College of Surgeons' biennial study course 2002 - 2004 elaborates on NF on 3 occasions[11-13]. The essentials of treatment for necrotizing fasciitis cannot be better expressed than they are in this course. *"The most critical aspect of treatment is aggressive surgical debridement of **ALL** of the infected tissues. Usually the level of infection is far more extensive than clinically evident on examination and simple incision and drainage is insufficient"*[12].

Thus incision and drainage, partial excision of the gangrene, and aggressive, extensive excision of the gangrene are all a futile exercise. Only ***TOTAL*** *excision of **ALL** of the gangrenous tissue will save the patient's limb and his life.* ***TOTAL*** *excision of **ALL** of the gangrenous tissue can **ONLY** be done by making tentative incisions through apparently **NORMAL** tissue.* The appearance of thick, foul smelling pus, sometimes accompanied by gas, brown fluid or frankly gangrenous tissue reveals the underlying truth. The skin feels normal, looks normal and frequently does not manifest crepitus.

Patients and Methods

Patients were seen in the male and female casualty surgical wards at the University Teaching Hospital on referral from the casualty area, or from the medical, gynecological or pediatric wards. Those having a diagnosis of NF were included in this study. Patients having other diagnoses such as "dermal gangrene, Fournier's gangrene, cancrum oris, or dirty wound" were excluded, even if the history and physical findings were suggestive of NF. They were evaluated clinically, treated with intravenous electrolytes and antibiotics, cross-

matched for blood as needed and prepared and scheduled for emergency surgery in the casualty theatre. Under general anaesthesia "sloughectomy" (S) was carried out. In some cases only incision and drainage was performed.

Incisions were optimally repeated radially away from the epicentre of the infection until COMPLETELY normal tissue was encountered. Then all tissue down to and including the fascia was removed. Any necrotic tendons or muscle were also removed. Electrocautery was essential to reduce bleeding to a minimum, and blood transfusion was given, if available and indicated, bearing in mind that the patient had almost certainly low hemoglobin due to haemolysis by the infecting organisms. Following the "sloughectomy", the patient was kept overnight in the casualty ward and discharged home the following morning when appropriate. In those cases in which the patient was seriously ill, the patient was admitted to the main hospital wards, and continued to receive IV fluids and antibiotics. Crystalline Penicillin 2 million units 6 hourly, Gentamycin 240mg o.d. and Metranidazole 500mg t.i.d., were given intravenously. The antibiotics were begun as soon as possible and always before surgery. Fluconazole was given for Candida infection.

Sometimes, the patient needed to be returned to the operating theatre for a second or a third debridement, and some second and third (or fourth) debridements under pethidine analgesia and topical lignocaine dropped onto the bare muscles, were done in the intensive care unit or on the wards.

Postoperative care included:

1. Cleaning of the wound was ideally carried out three times a day. [The best solution is hydrogen peroxide 50:50 in N/Saline (100% hydrogen peroxide burns badly)]. Silver Sulfadiazine (Flamazine), when available, was then applied as in burn care, or the wound was covered with Saline soaked dressings. When all the pus had cleared away and granulation tissue was laid down as a pink carpet, the raw area was ready for skin grafting.
2. Split thickness and widely meshed skin grafts were ideally used to ensure take in the presence of infection and to expand the graft to cover a large surface area.
3. Prevention of contractures was an important part of care and
4. physiotherapy, exercises, and in the case of the neck, neck extension with a pillow under the shoulders was ideally given.

Statistics were gathered from the Casualty theatre log book of operations performed for NF and of deaths from this condition after surgery from the monthly mortality and morbidity reports of the five surgical firms. These statistics were evaluated separately for the years 2003 and 2004 from January 1st to December 31st and for each sex. They were also evaluated separately for children of each sex. Mortalities were accepted as being due to NF only if this was the only cause, or the main cause of death. The site of the disease and the operative procedures were also noted.

Results

A total of 126 patients underwent surgery for diagnosed NF. Their ages ranged from 1 week to 73 years with an average of 31 years and 2 months (Table 1). Of these 77 were males aged 1 week to 73 years (average 34 years, 8 months) and 49 were females aged 2 weeks to 64 years (average 27 years, 7 months).

Sixteen of the patients were children aged 1 week to 15 years; 6 were boys aged 1 week to 11 years (average 3 years, 6 months) and 10 were girls aged 2 weeks to 15 years (average 5 years, 3 months). Five males and 2 females underwent a second in theatre operation (all "sloughectomy") for a total of 133 operations. Only 1 patient, a male, had a second operation in 2004 (Table 1).
In 2003, 53 males and 28 females underwent primary surgery compared to 24 males and 21 females in 2004. The location of the disease varied. The commonest locations were the legs followed by the feet, the arm, and the neck (Table 2.)

Operations

In 2003, 42 "sloughectomies" (S) were carried out in 29 males and 13 females; 7 incisions and drainage (I & D); 7 (I & D with S); 9 fasciotomies (F); (6 F with I & D); and 10 other procedures (5 with Sloughectomy) - in one case

the word "debridement" was used. (Table 3). Fifty four patients or 66.6% underwent Sloughectomy with or without other procedures.

Table 1. Age and Sex Distribution of Patients Undergoing Surgery for NF in 2003 / 2004.

2003			**2004**		
M	F	Total	M	F	Total
53	28	81	24	21	45
Second in Theatre operation			Second in Theatre operation		
4	2	6	1	0	1
Total in Theatre Operations			Total in Theatre Operations		
57	30	87	25	21	46
Age			**Age**		
1 week to 64	11 Months to 62	1 week to 64	11 to 73	2 weeks to 64	2 weeks to 73
Average Age	**Overall Average Age**		**Average Age**	**Overall Average Age**	
29 Yrs 8 Moths	28 yrs 7 Months	29 Yrs 3 Months	39 Yrs 9 Months	26 Yrs 9 Months.	33 Yrs 7 Months
Ages not recorded: M = 1. F = 1.			Ages not recorded: M = 1. F = 0.		
All Patients			**Children**		
M		F	M		F
Total			Total		
77		49	6		10
126			16		
Second Theatre Operation			**Second Theatre Operation**		
5		2	0		0
7			0		
Total in Theatre Operations			**Total in Theatre Operations**		
82		51	6		10
133			16		
Ages			**Ages**		
1 Wk to 73 yrs.	2 Wks to 64 yrs.	1 Wk to 73 yrs.	1 Wk to 11 Yrs	2 Wks to 15 Yrs	1 Wk to 15 Yrs
Average Age			**Average Age**		
34 Yrs 8 Months.	27 Yrs 7 Months.	31 yrs 2 moths.	3 Yrs 6 Months.	5 Yrs 3 Months.	4 Yrs 7 Months
Ages not Recorded: M = 2, F = 1.			**Ages not Recorded** = 0.		

Table 2. Location of Disease

2003				**2004**			
Location	**Rt**	**Lt**	**Not Stated**	**Rt**	**Lt**	**Not Stated**	**Total**
Leg	14	8	1	7	5	2	37
Leg & Foot	1	1	-	-	-	-	2
Foot	8	7	-	2	4	-	21
Axilla	-	-	-	-	-	2	2
Arm	5	6	-	1	2	-	14
Hand	-	-	-	1	1	-	2
Neck & Submadibular	-	-	4	-	-	5	9
Groin	1	1	1	-	-	-	3
Breast	2	-	-	-	1	-	3
Perianal & Abdomen			2	-	-	-	2
Perineum	-	-	2	-	-	1	3
Gluteal/Hip/Iliac	2	2	-	-	-	-	4
Chest Wall	1	-	-	-	-	2	3
Anterior Abdominal Wall	-	-	-	-	-	2	2
Miscellaneous (1 each): Scalp, Neck and Temporal region, Abdominal wall, Scrotum and peritoneal cavity, Thigh, groin and Psoas, Mediastinitis, Chest and abdomen, perineum, abdominal wall and ischiorectal region, Finger, Trunk, Arm with chest wall.							10
Site not stated:			2003 = 6.			2004 = 2	8

CHILDREN:			**2003**	**2004**			
Location	**Rt**	**Lt**	**Side not Stated**	**Rt**	**Lt**	**Side not Stated**	**Total**
Leg	2	-	-	1	-	-	3
Foot	2	1	-	1	-	-	4
Arm	1	-	-	-	1	-	2
Groin	1	-	1	-	-	-	2
Miscellaneous (1 each)	Breast. 1			Trunk; Chest wall; Ant abdominal wall 3			4
Site not stated				1			1
Total	**9**			**7**			**16**

Table 3. Primary Operations – All Patients

2003				**2004**		
Operation	**M**	**F**	**Total**	**M**	**F**	**Total**
Sloughectomy (S)	29	13	42	20	15	35
I & D	4	3	7	-	2	2
I & D + S	4	3	7	1	1	2
Fasciotomy (F)	6	3	9	-	1	1
I & D + F	3	3	6	-	-	-
Others	7	3	10	3	2	5
Total	**53**	**28**	**81**	**24**	**21**	**126**

In 2004, 35 Sloughectomy operations were carried out in 20 males and 15 females; 2 had incision and drainage (I & D); 2 had I & D with Sloughectomy; 1 had fasciotomy (F); and five other procedures(3 with S). Forty patients (88.8%) underwent Sloughectomy with or without other procedures.

Mortality

There were 17 deaths (20.9% Mortality rate). Eight were males and 9 females in 2003 and 10 deaths (22.2% Mortality) in 2004; four were males and 6 females in 2004. The total mortality for the two years was 27(21.4%). The ages ranged from 4 months to 58 years (average 30 years, 3 months in males) and 16 years to 70 years (average 32 years, 3 months in females) in 2003.

In 2004 the ages ranged from 33 to 43 (average 32 years, 3 months in males) and 23 to 54 (average 35 years, 7 months in females) (See Table 4). The locations of the disease and the complicating factors which influenced outcomes are detailed in the Table 4.

Discussion

This retrospective study of the management and outcomes after treatment of necrotizing fasciitis at University Teaching Hospital, Lusaka, covers an evolutionary phase beginning at the end of 2003, when preventive treatment in the form of adequate incision and drainage (I & D) of abscesses (wide enough, deep enough and dependent) was being emphasized, along with discussions on the wards, in the casualty area and at post-graduate presentations of NF at UTH, at the Zambian Surgical Society annual meeting and at the ASEA/ COSECSA meeting in Harare, Zimbabwe.

Many surgeons and anesthetists are daunted by the area of raw surface left behind after adequate tissue removal and tend to restrict the area of dead tissue removed. Such a move is likely to prove catastrophic, since the disease spreads very rapidly and systemic toxicity occurs very swiftly when **any** dead tissue is left in the body. Very large areas of raw surface, even as much as 20% or more of the body surface area, are remarkably well tolerated if the dead tissue has been adequately removed and the patient receives broad spectrum antibiotics. The wounds clean up over the succeeding days and any systemic toxicity gradually clears up (including cerebral toxicity with coma - if ventilatory support is provided as needed).

It is seen from the above table that the mortalities occurred in patients who were desperately ill on arrival at the hospital, and most of these were preterminal or moribund. Nevertheless radical debridement is still worthwhile and may even save some these patients. Mortality rates drop markedly when **early** adequate debridement is carried out. Indeed, in 1997 the Majewskis, who used frozen section biopsies to confirm the diagnosis, and emphasized early diagnosis and treatment with total debridement, reported a series of 12 cases (average age 61) over a 15 year period with zero mortality and only 1 amputation. The average time from arrival of the patient to operation was 4 hours. .

It must be emphasized that immunosuppression is not a contraindication to radical treatment. On the contrary, it is a strong indication for it, and many such patients will do remarkably well when **appropriate** treatment is given. The marked drop in the incidence of cases of necrotizing fascitiis in 2004 is difficult to explain, but may be partially due to better drainage of abscesses. This is especially true in the case of submandibular abscesses (often related to poor or complete lack of dental care) which spread rapidly to the neck and sometimes into the mediastinum, resulting in a fatal outcome.

There was a laudable increase of S (including S with other procedures) from 66.66% to 88.88% and a reduction of I & D (including I & D with F) from 16% to 4%. While further attention to complete removal of **all** necrotic tissue can be expected to improve results, tackling the far more thorny problem of getting proper attention to patients at an **early** stage of their disease can

be expected to have a profound influence on mortality.

Acknowledgement

We are indebted to Dr. Abdukarim, the anesthesia and ICU nursing staff for their superb respiratory and intensive care support which enabled the survival of some of these very sick patients.

References

1. Stevens DL. Streptococcal toxic shock syndrome associated with necrotizing fasciitis. Annual Rev Med.2000; 51:271-288.
2. Adigun I.A. and Abdulrahaman L.O. Necrotizing fasciitis in a plastic surgery unit: a report of ten patients from lIorin. Nigerian J. Surg. Res.2004;6(1-2):21-24
3. Meleney FL.Hemolytic streptococcus gangrene. Arch. Surg.1924;9:317-364. Syllabus, Am. Coil. Surg.
4. Syllubus. Am Coll surg. SESAP, 2002-2004; 11:294.
5. Gutierrez A., Florencio R, Ezpeleta C. et al. Fatal intravascular hemolysis in a patient with Clostridium perfringens septicemia. Clin. Infect. Dis. 1995; 20:1064-1065.
6. Schwartz RA, Kapila R Necrotizing fasciitis. emedicine. 2005.
7. Mandell GL et al., eds. Necrotizing fasciitis. In Mandell, Douglas and Bennett's Principles and Practice of Infect. Dis. 2000 5th ed., vol 1, Philadelphia:Churchill Livingstone: 1053-1057.
8. Chapnick EK, Abter EI. Necrotizing soft tissue infections. Infect. Dis. Clin. North Am.1996; 1 0:835-855.
9. Neal MS. Necrotizing fasciitis. J Wound Care. 1999; 8:18-19.
10. Ash S. Deep soft tissue infection. Fasciitis and myositis in Schlossberg D (Ed). Current therapy of Infect. Dis. St.Louis, Mosby 2001; 70-72.
11. Syllabus, Am Coll Surg. SESAP, 2002-2004; 11:295.
12. Syllabus. Am.Coll.Surg. SESAP, 2002-2004; 11:27.
13. Syllabus, Am. Coll. Surg. SESAP, 2002-2004; 11:204.
14. Majewski JA, Majewski E. Necrotizing fasciitis. Improved survival with early recognition by tissue biopsy and aggressive surgical treatment. Southern Med. J.1997; Nov. Current concepts. (Also Accessible via Internet http.www.sma.org/smj1997/novsmj97/1text.htm) [Then seen in UPC Med.Dir]
15. Mohammedi I., Ceruse P., Duperret S., et al. Cervical necrotizing fasciitis. 10 years experience at a single institution. Intensive Care Med 1999; Aug.25 (87):829-34.