

MANAGEMENT OF CONTRACTURES: A FIVE-YEAR EXPERIENCE AT KOMFO ANOKYE TEACHING HOSPITAL IN KUMASI

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SUMMARY

Background: Contractures are common complications of wounds healing by secondary intention; some cases are idiopathic and a few are congenital. Contractures cause significant morbidity to patients.

Objective: The study was undertaken to document the pattern, spectrum and management of patients with contractures of various types and aetiologies presenting at a Plastic and Reconstructive Surgical Unit in Ghana.

Design: Prospective study from January 2004 to December 2008.

Setting: Komfo Anokye Teaching Hospital (KATH) in Kumasi

Patients and Methods: The age, sex, site, extent and cause of contracture was documented. The patients were examined and functional impairment recorded. A clinical photograph was taken. Patients requiring surgery had their contractures released and the defect repaired with an appropriate reconstructive technique. Patients with minimal functional impairment underwent physical therapy without surgery.

Results: Sixty-eight patients comprising 44 males and 24 females were seen. Male to female ratio is 1.83:1. Their ages ranged from 0.66 to 60 years, mean age was 22.53 years. Seventy-six contractures were studied. Fifty-eight of the lesions were in the upper part of the body. Burns, infections and trauma were the main aetiological causes. Seventy-one surgical procedures were performed including release and flap repair (33), full thickness skin graft (23) and partial thickness skins graft and splinting (six).

Conclusions: Thermal burns and soft tissue infections are the commonest causes of contractures presenting at KATH in Kumasi. These causes of contractures are preventable by early and adequate treatment of the acute conditions.

Keywords: Contractures, myofibroblasts, Volkmann's, Buruli ulcer, Dupuytren's, Burns

INTRODUCTION

Contractures complicate several wounds healing by secondary intention. This is because healing by secondary intention results in shortage of skin in all directions.¹ When skin shortage occur in the region of a

joint, it causes a limitation of movement and a contracture results.² Contractures can also result from closed traumatic injuries especially to the extremities,³ from oedematous swelling and subsequent fibrosis from chronic infections.⁴ The presence of congenital⁵ and idiopathic⁶ forms of contractures imply that trauma and inflammation need not be present for the development of all types of contractures.

The basic mechanism for the formation of contractures of various aetiologies – congenital, acquired or idiopathic – is the same.^{6,7} The process is due to the action of the myofibroblast – a cell with fibroblast and smooth muscle characteristics distributed throughout granulation tissue present in wounds.⁸ Contraction of myofibroblasts shrink the wound. This is followed by collagen deposition and cross-linking to maintain contraction.⁷ It is also known that contraction of the palmar fascia and surrounding structures in Dupuytren's contracture is directly related to the contractile properties of myofibroblasts.⁸ In embryogenesis, failure of differentiation of the digits leads to scar tissue formation, which flexes the proximal inter-phalangeal joints with resulting camptodactyly.⁵

Contractures can cause significant functional and/or cosmetic problems to patients.¹ The condition is common amongst Ghanaian patients but there is a paucity of information in the literature about the spectrum, pattern, incidence and management options. A survey in children aged five years or younger in Ashanti Region in Ghana, which is within the catchment area of Komfo Anokye Teaching Hospital, by Forjuoh et al⁹ in 1992 indicated that 113 (17.4%) of 650 childhood burns resulted in the development of physical impairments. The majority were keloids (79.%) while 6% were contractures and amputations. Only five (0.8%) cases involved a physical disability, in the form of difficulty in performing the activities of daily living such as walking, eating, standing without support, putting on clothes or playing with peers.

Authors elsewhere tend to concentrate on management of contractures affecting a particular site of the body such as the axilla^{10,11} the hand,¹² the neck,¹³ or the foot.¹⁴

Other authors are interested in contractures of a particular aetiology such as burns,^{12,15} trauma,³ Buruli ulcer,⁴ cancrum oris¹⁶ or Dupuytren's contracture.^{6,8} The current study was undertaken to document the spectrum and management of patients with contractures of various types and aetiologies presenting to the author at the Plastic and Reconstructive Surgery Unit of Komfo Anokye Teaching Hospital in Kumasi.

PATIENTS AND METHODS

A five-year prospective study of patients with contractures of various types presenting to the author at the Reconstructive Plastic Surgery and Burns Unit of Komfo Anokye Teaching Hospital in Kumasi was undertaken from January 2004 to December 2008. A clinical history to document the name, age, sex, the cause of the contracture, the site involved and the extent of the deformity was taken.

The patient was examined clinically and the extent of functional and/or cosmetic impairment was recorded. A clinical photograph of the contracture was then taken. Several classifications exist in the literature for contractures involving certain sites of the body such as the axilla,¹¹ neck,¹⁷ or hand.¹⁸ There is also the international classification of impairments, disabilities, and handicaps by the WHO.¹⁹ The classification of Sheridan et al²⁰ and McCauley²¹ for the hand was modified for the current study involving all sites with contractures.

This classification is useful for assessing function before and after surgical and physical management of contractures, though it lacks the scope of the socio-cultural handicaps contained in the WHO classification. Patients with contractures in Grade III and IV of this modified classification had surgical release of their contractures. The defect was repaired using a technique appropriate for the site involved. Patients with contractures belonging to Grade I and Grade II did not require surgery. They underwent manipulation under anaesthesia and regular physical exercises at the Physiotherapy Department to regain full function.

Post-operative patients in category B also had further exercises to maximize function. The severity categories before the onset of the interventions – both operative and non-operative - were assessed as follows: Grade I (0%), Grade II, two (3%), Grade III, 42 (62%), Grade IV, 24 (35%).

Table 1: Classification of Contractures

Severity Category
Grade I: Symptomatic tightness but no limitation in range of motion or function
Grade II: Mild decrease in range of motion or mild impairment of function, but without significant impact on activities of daily living, no distortion of normal architecture
Grade III: Functional deficit noted, with early changes in normal architecture of the site or part.
Grade IV: Loss of function of the site or part
Outcome Category
A – Excellent (Normal function)
B – Good (Abnormal function, but able to perform activities of daily living)
C – Poor (Cannot perform activities of daily living)

RESULTS

The study period extended from January 2004 to December 2008. A total of 68 patients were seen, made up of 44 males and 24 females. The male to female ratio is 1.83:1. Their ages ranged from 0.66 to 60 years with a mean age of 22.53 years.

Table 2: Age of Patients with Contractures (N=68)

Age (Years)	Frequency	Percentage
0-10	21	30.88
11-20	15	22.06
21-30	15	22.06
31-40	10	14.71
41-50	3	4.41
51-60	4	5.88

Sites Involved

A total of 76 contractures were found in 68 patients. 51 (67.11%) of the contractures involved the upper limb, 31 (40.79%) involved the hands, nine (11.89%) involved the elbow, nine (11.89%) involved the axilla, and two (2.63%) involved the wrist. Fourteen (18.42%) of the contractures occurred in the lower limb, five (6.58%) involved the knee joint, four (5.25%) each involved the ankle and foot. The hip joint was involved only once.

Apart from the limbs, the head and neck region was the next most susceptible, accounting for nine (11.89%) of the contractures. There was one perineal contracture and one groin contracture. They caused the most severe functional impairment – anal stenosis in one case and obstruction of the vaginal introitus in another case (Figure 1).



Figure 1 Post burn groin contracture in a nine – year old girl.

Multiple site involvement occurred as follows: head, neck and axilla – two, hip and knee joint – one, foot and ankle – two, axilla and elbow – two, hand, wrist and elbow – one (Figure 2)



Figure 2 Contracture from Buruli ulcer, showing multiple joint involvements.

Aetiology

Burns accounted for 44 (64.71%) of the total number of contractures; out of that 41 (60.29%) were due to thermal burns; two (2.94%) were due to chemical burns sustained through assault, one (1.47%) was due to electrical burns to the hand. Seven (10.29%) of the contractures were due to traumatic causes, mostly resulting in Volkmann's ischaemic contracture.

Twelve (17.65%) of the contractures resulted from infections, with Buruli ulcer accounting for seven

(10.29%), and cellulitis accounting for four (5.88%). One patient had a contracture involving the temporo-mandibular joint from cancrum oris. Dupuytren's contracture occurred in four (5.88%), all of them aged 50 and above. There was only one congenital cause of contracture, a camptodactyly of a middle finger (Table 3).

Table 3 Aetiology of Contractures (N=68)

	Agent	Number	Percentage
1.	Thermal Burns	41	60.29%
2.	Chemical Burns	2	2.94%
3.	Electrical Burns	1	1.47%
4.	Post-traumatic (Volkmann's)	7	10.29%
5.	Infections	12	17.65%
	Buruli ulcer	7	
	Post-cellulitis	4	
	Cancrum oris	1	
6.	Idiopathic (Dupuytren's)	4	5.88%
7.	Congenital (camptodactyly)	1	1.47%

Surgical Procedures

A total of 73 procedures were performed on 68 patients with contractures. Three patients required two procedures each. The contractures recurred in two patients from graft failure and the defects had to be repaired with pedicled flaps.

Thirty-three (45.21%) of the patients had their contractures released and the defects repaired with a pedicled flap. The most popular flap in this series was the cross finger²² flap, eight (10.96%) of which was used to repair defects on the digits. The parascapular²³ flap was used to repair six (8.22%) defects from axillary contractures; (Figures 3a, 3b), the square²⁴ flap was used to repair cubital fossa defects in three (4.11%) cases. 23 (31.51%) of the contractures were repaired with full thickness skin grafts. Four (5.48%) cases involving the digits were repaired with partial thickness skin grafts after Kirchner (K)-wire fixation of the released digits. In six (8.22%) of the cases partial thickness skin grafts were used to repair the defects but the limbs were splintered with plaster of Paris (POP), and the necks splintered with cervical collar,²⁵ for a minimum of three months to prevent recurrence of the contractures.



Figure 3a Left axillary contracture from burns (pre-operative).



Figure 3b Post operative, after release and parascapular flap repair.

Excision and direct closure of a contracture was possible in only one case involving a thumb. Fasciectomy was performed for four cases of Dupuytren's contracture. Two recurred but were managed by active and passive exercises, without further surgery.

Two patients with grade II contractures involving the elbow (one case) and the knee (one case) were managed by manipulation under anaesthesia followed by regular exercises by the physiotherapist.²⁷

After the above interventions, functional outcome was assessed as excellent in 25%, good in 65% and poor in 10% of the patients. The latter are being worked up for further surgery and physical therapy.

It is apparent from the above that the institution of the above interventions, both operative and non-operative, improved the ability of majority (90%) of the patients to perform their activities of daily living. Moreover since more people were able to resume their normal duties at work, the interventions improved productivity for the nation.

DISCUSSION

The magnitude of the problem of contractures in Ghana is not precisely known. Data on the condition is very scanty and is usually discussed in connection with Buruli ulcer⁴ and burns.⁹ Other authors highlight on new techniques designed for managing contractures involving special sites in the body.^{10,11,13} There is therefore the need for a comprehensive study of the spectrum, pattern, incidence and treatment options for contractures in Ghana.

All scars tend to shorten and distort the normal architecture of the anatomical site involved.² A limitation of movement occurs when this occurs in the region of a joint. This joint limiting pathological end result of excessive wound contraction constitutes a contracture. Contractures usually tend to occur on the flexor surfaces of joints as flexor muscle pull is usually stronger than extensor.²

The prevalence of the contractures in this series was higher in children aged 10 years or younger. This age group is known to have the highest incidence of burns,¹⁵ sustained usually at home from hot water, soups, and from naked flames like candles. The contractures were hence mostly post-burn and involved the extremities and trunk, though one involved the groin and another involved the perineum.

These findings are similar to those of Forjuoh et al⁹ in Ashanti Region in 1992 which showed a high prevalence (17.4%) of physical impairments from childhood burns in children aged five years or younger. This study identified a link between maternal education and childhood morbidity from burns, and recommended enhancement of female access to formal education to reduce burn related physical impairments.

Possibly this factor has not improved over the years. Olabangi et al²⁸ also found that 58% of their 76 patients with contractures in Ile Ife, in Nigeria, were children aged 0 to 15 years. The upper half of the body, made up of head and neck, upper limbs and upper trunk appears to be more at risk of developing contractures; about 79% of the contractures occurred in these regions. About 41% of the contractures involved the hand only. These regions are more exposed to the agents that cause contractures, usually work related or domestic injuries or from assault.

Of the aetiological agents considered in this series, thermal, chemical and electrical burns accounted for about 65% of the contractures, emphasizing the important role burns play in the aetiology of contractures. Proper management of the acute burns can prevent these contractures.²⁹

Good positioning of the burned patient, especially for major and deeper burns of the hands, head and neck is an effective way to prevent contractures.²⁷ Splinting is used if the patient is not able to voluntarily maintain proper positions. Passive movements of the joints are done when patients cannot co-operate; as soon as they can co-operate active exercises are encouraged.²⁷ Early excision and skin grafting²⁹ of deeper wounds, or skin grafting of any burn wound of more than 3 weeks duration effectively reduces the chances of development of contractures.

Once developed contractures are difficult to treat because of the tendency to recur. The use of a flap is the only surgical procedure that offers functionally and cosmetically satisfactory results.^{11,12} Contractures resulting from traumatic causes were mostly due to ischaemia. Volkmann's ischaemic contracture³ results when an increase of pressure in the fascial compartments of the forearm, hand or lower extremities causes venous stasis, muscle ischaemia, necrosis and transformation into scar.

Ischaemic muscles degenerate and through fibroblastic proliferation become fibrotic and contracted. Nerves are compressed but may also be affected by necrosis. Aetiologically, displaced supracondylar fractures of the humerus in children aged 3 and 13 years are a classic cause.³ In the Ghanaian situation bandages or casts applied especially by unqualified practitioners are the commonest causes.

In established cases muscle shifting operations, lengthening tenotomies and tendon transfers are useful. Neurolysis or nerve reconstructions may be necessary.³ Buruli ulcer⁴ and cancrum oris¹⁶ are necrotizing infections; Buruli ulcer is a specific ulcer caused by mycobacterium ulcerans whilst cancrum oris or noma is caused by *Bacteroides fusiformis*, *Borrelia vincenti* and hordes of other organisms, acting synergistically. Of the infectious agents, they cause the most devastating contractures.^{4,30} Fortunately contractures from both agents can be prevented. In the case of Buruli ulcer early detection of the lesions in the nodular or pre-ulcerative stage and excision leads to a cure.⁴ *Mycobacterium ulcerans* is susceptible to rifampicin-streptomycin combination, and treatment for 8 weeks can result in cure in 30-50% of cases. Some cases also require a combination of surgery and antibiotics.⁴

Cancrum oris¹⁶ causes tissue loss of the oral mucosa and muscles, with contracture of the temporalis, masseter or medial pterygoid muscles, with dystrophic calcification, leading to trismus. Reconstruction involves release of trismus and mobilization of the mandible, release of all structures distorting facial features, and

providing lining and cover for lost lips, cheek or nose, using flaps.¹⁶ In our case the cheek defect was repaired with a doubly-folded delto-pectoral flap.

Cancrum oris can be prevented by improving nutrition in children, immunizing them against debilitating illness such as measles, and improving oral hygiene.¹⁶ Dupuytren's disease is characterized by nodular fibroblastic proliferation of the palmar fascia often leading to contracture of the hand, most frequently affecting the ring and small fingers.³¹ Progression of the disease and recurrence of palmar contracture and scar formation after treatment lead to notable disability. Dupuytren's disease in the hands is commonly bilateral but Dupuytren-like fibrotic tissue can occur on the dorsum of the hands over the knuckles (Garrod's nodes) feet (Lederhose's disease) and penis (Peyronie's disease) of the same individual.³¹

Dupuytren's disease is most prevalent in northern European whites – one of the most commonly inherited connective tissue disorders affecting whites of northern European descent. Dupuytren's disease is believed by some authors to occur only in Caucasians who are descendants of the Vikings; the disease is hence known to be rare in Africans and Chinese.³² The finding of the condition in Ghanaian patients who are black Africans and hence not descendants of the Vikings negates this hypothesis.

Surgical options include fasciotomy when only the fascia is transected, regional fasciectomy where only diseased fascia is excised, extensive fasciectomy where diseased or potentially diseased fascia is excised. Dermatofasciectomy may be done for recurrent disease.²⁶ It is known that good correction can be achieved by surgery but treatment has a high complication rate and a significant rate of recurrent contracture, especially with more severe initial deformities. Those with good initial correction are less likely to recur.²⁶

About 14 % of the patients presented with socio-cultural handicaps associated with contractures located in special sites such as the perineum, groin, head and neck. The perineal and groin contractures involved the pubic area, the external genitalia and the peri-anal area. Even though the surgical interventions described previously had been performed, the patients, who were children aged eight and nine, could neither bath in the open, like other children in the community because of the fear of being stared at; nor could they play with their peers, as playing in their communities involved running, jumping, climbing, squatting among others.

The parents of these children were also anxious about the possibility of later sexual dysfunction and infertility. The patients with contractures involving the head and neck, especially the face had greater handicaps, as their scars were more conspicuous. The women were especially distressed by their reflection in their own mirrors. They felt uncomfortable when they come face to face with strangers, and also with their peers, who would stare at them and then turn away.

This made travelling, work or schools a stressful experience; some of them tendered to avoid social contacts. Two children had dropped out of school at the time they were first seen. One young man who had mento-sternal contracture release could not be enlisted in the armed forces because of the presence of scars on the neck and chin, though this had been his whole life ambition. It is clear that surgery alone is insufficient in addressing these concerns. Such patients require informed supportive counselling which can be better provided by clinical psychologists, child psychologists and occupational therapists.

The senior nursing staff of the Plastic and Reconstructive Surgery Unit usually provided pre-operative counselling and reassurance. After the surgical procedures discussed previously had been performed the patients were referred to the Department of Behavioral Sciences, and the Physiotherapy Unit of Komfo Anokye Teaching Hospital for the appropriate counselling and therapy. Psychologists are better equipped than surgeons in providing supportive self-help advice to enable patients focus on their social skills; this would enable them to discover how to take more control over their social encounters. Since plastic surgical services involve sociocultural and ethical problems it is recommended that each of the two plastic surgery units in Ghana should have its own counselling unit to handle such problems effectively.

The results of the surgical interventions employed in this study are comparable to those of other authors. Asuku³³ treated 74 children aged less than 15 years with post burn axillary contractures in Kaduna, Nigeria, from 1998 to 2002. Using the Kurtzman and Stern classification¹⁸ the patients were grouped as follows: type I 56, type II eleven, type III seven. Type I contractures were repaired with local flaps, type II contractures were repaired with local flaps and skin grafts, type III contractures were either incised or excised and the defect repaired with skin grafts. At assessment, the functional outcome was excellent in 57%, good in 29% and poor in 14% of the cases. In the current study, 25% were assessed as excellent; 65% as good, and 10% as poor.

It is apparent that by restricting himself to only axillary contractures, and using well-defined reconstructive criteria for the axilla, the former was able to achieve excellent results in more patients; however more people were enabled to perform their activities of daily living with the current study. Ogawa et al¹⁰ did a retrospective study of 134 axillae treated in 124 cases of axillary scar contractures with the use of skin grafts and various flaps over 25 years in the Department of Plastic and Reconstructive Surgery of the Nippon Medical School in Tokyo, Japan.

The results were generally satisfactory, but five problematic cases (mainly due to flap necrosis) and seven cases of recurrence were encountered. In the current study involving several sites with contractures, over a period of five years, four recurrences were encountered. Two due to graft failure were repaired with pedicled flaps. Two recurred Dupuytren's contracture were managed conservatively with physiotherapy.

CONCLUSIONS

Thermal burns and soft tissue infections are the commonest causes of severe contractures that involve especially the hands and upper half of the body. Children and young adults are particularly at risk. These causes of contractures can be prevented by early and adequate treatment of the acute forms of these conditions.

RECOMMENDATION

To achieve satisfactory functional and cosmetic result established contractures should be released and the defect reconstructed with an appropriate flap.

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