

Results of the treatment of phlegmon of *Streptococcus pyogenes* aetiology within upper limbs

Andrzej Żyluk^{A✉}, Piotr Puchalski^B, Zbigniew Szlosser^C

Pomeranian Medical University in Szczecin, Department of General and Hand Surgery, Unii Lubelskiej 1, 71-252 Szczecin, Poland

^AORCID: 0000-0002-8299-4525; ^BORCID: 0000-0002-0865-1647; ^CORCID: 0000-0002-7334-7932

✉ azyluk@hotmail.com

ABSTRACT

Phlegmon is a purulent infection which spreads in loose connective tissue. It occurs most commonly in the limbs as a complication of other local infections. Untreated or inadequately treated infections in the skin of the fingers or hands are susceptible to phlegmon. In most cases, the infecting organism is *Staphylococcus aureus*. This article reports 7 cases of phlegmon involving upper limbs, caused by the *Streptococcus pyogenes* organism. The course of these types of infection are more serious, and the range of tissue damage greater, than those caused by staphylococci. This article presents the causes of the phlegmon, the methods and course of management, and the

results of these. The principles of surgical management include wide incisions in the skin and an evacuation of pus and necrotic tissue debris. The skin is then sealed with stitches or a skin graft once the wound is clean. Of the 7 treated patients, 1 died in the intensive care unit due to sepsis and multi-organ failure and 1 patient lost his all fingers due to necrosis. The authors believe that it is desirable that doctors working in emergency units and surgical admission rooms should be familiar with the basic rules of diagnosing and managing these potentially life-threatening or hand crippling disease

Keywords: *Streptococcus phlegmon*; sepsis; tissue necrosis.

INTRODUCTION

Phlegmon is a purulent infection which spreads in the loose connective tissue. It may develop in any body part, but most commonly it involves the upper limbs. Phlegmon is usually a complication of other local infections, a typical example is its development in the hand and forearm as a consequence of inadequately treated or untreated felons or infected wounds in the digit. In most cases, the infecting organism is *Staphylococcus aureus* and less frequently *Streptococcus pyogenes*. Factors which lead to the predisposition of the disease include diabetes (particularly if its poorly controlled), old age, chronic alcoholism, immunodeficiency due to systemic steroids therapy, chemotherapy, or HIV infection. Classic signs and symptoms of phlegmon:

- strong pain in the infected part of the limb (e.g., the whole hand or forearm),
- warmth and a red tinge of the skin over the area infected with phlegmon,
- swelling and increased skin tension over the involved area,
- these signs involve much greater area than it is in infected wound or abscess,
- reduction in the movement of the fingers and wrist due to pain and swelling,
- mild fever may be present but usually without systemic reaction.

A trend is observed in several recent years to increase amount of phlegmone of *Streptococcus* aetiology treated in the authors institution. These infections are more dangerous than

those caused by *Staphylococcus aureus*, their course is more vigorous, with systemic signs and symptoms, frequently leading to the development of sepsis. Basic features of this infection are listed in Table 1, example Figures 1 and 2. As with fasciitis necroticans, *Streptococcus pyogenes* infections are more likely to involve patients with diabetes and immunodeficiencies. Patients affected with this type of phlegmon require hospitalization and rapid surgical treatment including incisions in the skin involved and the subcutaneous tissue, and the evacuation of pus collections followed by the excision of necrosis. Usually, these procedures should be repeated several times until the tissue is clean from purulent debris. Antibiotic therapy is also necessary. *Streptococcus pyogenes* phlegmon may be complicated by a necrosis of the digits or even the whole limb, resulting in their amputation. In the worst case scenario, sepsis may develop which is life-threatening. Most patients who eventually recover need split-skin grafts to cover skin defects.

TABLE 1. Typical features of phlegmon caused by *Streptococcus pyogenes*

A rapid spread of the infection in the soft, subcutaneous tissue
Skin necrosis, development of bulbi and epidermis detaching over the infected area
Serious systemic reaction with fever and malaise
Real danger of the development of sepsis
In biochemical blood tests: elevated leukocytes count, C-reactive protein (CRP; usually hundreds mg/dL) and procalcitonin concentration (in sepsis)



FIGURE 1. Typical appearance of *Streptococcus pyogenes* phlegmon of the upper limb



FIGURE 2. Appearance of *Streptococcus pyogenes* phlegmon of the upper limb with digital necrosis

This article presents the results of the treatment of 7 patients with phlegmon of *Streptococcus pyogenes* aetiology within the upper limbs. All cases were treated in the authors' institution.

PATIENTS AND METHODS

Over a period of 20 months, 2018–2019, 7 patients, 6 men and 1 woman, with a mean age of 43 years (range 26–84) with severe phlegmon of the upper limbs were treated in the authors' institution.

The duration of symptoms before admission was 1–5 days. The general condition of 5 of the patients was serious at the time of admission and they presented symptoms and signs of sepsis. In 6 of the patients, predisposing factors were identified: uncontrolled diabetes, old age, and malnutrition due to homelessness and alcoholism. The direct cause of infection for 4 of the cases was a minor wound in the digit or hand, none of which required a surgical closure; in the other 3 cases it was either a superficial skin abrasion on the hand, a cat scratch on the dorsum of the hand or a puncture wound in the finger by a plant spike. Results of biochemical blood tests showed highly elevated inflammatory parameters in all patients: the mean number of leukocytes was 13.6 G/L (range 8.4–24.7) and the mean of CRP was 247 mg/dL (range 112–570). Five patients with sepsis had procalcitonin levels elevated 1.5–36 ug/dL. No imaging examinations were performed in these patients

to confirm phlegmon diagnosis. The article shows an analysis of the methods and course of the treatment, the surgical procedures employed and the results.

METHODS AND COURSE OF THE TREATMENT

Surgery was performed on all patients: wide skin and subcutaneous tissue incisions were made ranging from the hand to the arm (Figs. 3 and 4). Typically, several incisions were made in various parts of the limb where pus deposits were suspected; in most patients these incisions were repeated daily (Fig. 5). Primary incisions were usually performed under brachial plexus block anaesthesia and tourniquet, and subsequent incisions under local anaesthesia. Four patients required excision of the necrotic skin which resulted in defects in the hand or in the forearm. One patient required amputation of his II–V fingers due to their necrosis (Fig. 2). In all patients swab tests were taken from the pus which, after culturing, revealed the presence of *Streptococcus pyogenes* organisms. These are sensitive to most antibiotics, including amoxicillin. An empirical antibiotic therapy was implemented in all patients with amoxicillin 4 x 1.2 g i.v. plus metronidazol 3 x 0.5 g i.v. which was continued as aimed therapy after obtaining an antibiogram. One patient with severe sepsis required treatment in the intensive care unit (ICU) and received multi-antibiotic treatment.

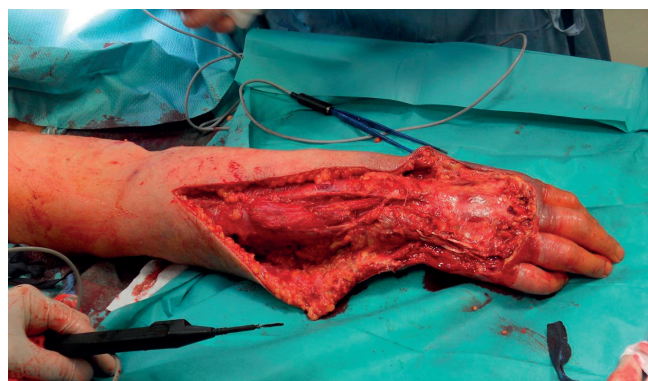


FIGURE 3. Intraoperative view of debridement of pus collections and necrotic tissue (dorsal side)



FIGURE 4. Intraoperative view of debridement of pus collections and necrotic tissue (palmar side)



FIGURE 5. A view of the incisions in the hand and forearm, several days after surgery



FIGURE 7. Final view of the hand of the patient from Figure 2. The thumb was saved

RESULTS

Six patients were admitted and treated in the authors institution and 1 female patient was moved to the ICU where she died after 5 days due to multi-organ failure. She was an 84-year-old woman who presented in the hospital with florid sepsis. She was additionally burdened by several concomitant diseases including unbalanced diabetes, arteriosclerosis and ischaemic heart disease.

In the remaining patients, the infection was successfully controlled by surgical procedures and aimed antibiotic therapy. Pus and tissue debris were cleaned from the wounds, and the skin necrosis was excised. The wound was then provisionally closed with stitches in 2 of the patients (Fig. 6). One patient, who had all his fingers amputated, required use of a pedicled thoracic flap to save his partly necrotic thumb (Fig. 7). Skin defects in the forearm were covered by a split-skin graft in 1 patient (Fig. 8). After treatment, 2 patients were discharged from the hospital to out-patient care with granulating wounds (Fig. 9). One of these patients began treatment in another institution with an unconventional, conservative method of therapy and did not return to the authors institution. Another patient also ceased visiting the out-patient clinic. Thus, of the 7 patients who were admitted with streptococcus phlegmon of the upper limbs, 4 were available for final assessment.



FIGURE 8. Skin defect covered by split-skin graft



FIGURE 6. Closing wounds with stitches



FIGURE 9. Clean wounds after the successful treatment of the case from Figure 1

The wounds of all 7 patients eventually healed. The duration of their stay in the hospital was 13 days on average (range 8–32). The results were assessed at a mean of 2 months after treatment was completed. Three patients who avoided amputation of their fingers consequently had poor functions in their hands (DASH scores 46–84), with only slight finger movement and no grip. The patient who had a 4-finger amputation obtained good hand functions (DASH score 20, Fig. 7) and, interestingly, returned to his original work as a truck driver.

DISCUSSION

Hand infections in young and healthy people are rarely life-threatening. More commonly they cause the hand more or less impaired [1, 2]. In contrast, patients with diabetes and immunodeficiencies can have complications which lead to finger or limb amputation, or can be fatal due to uncontrolled sepsis [3, 4, 5]. This particularly concerns *Streptococcus pyogenes* infections which are frequently complicated by excessive necrosis of the skin and soft tissue and the development of systemic blood infection [3, 4, 5, 6, 7]. Diabetes, which is a common occurrence in the population, constitutes an additional factor predisposing one to complications arising from an infection. The entry point of the disease is usually an apparently innocent, small wound in the hand or finger or even a superficial abrasion of the skin, which generally would not need surgical debridement. It is difficult to state where from staphylococci organisms originate but the most probably they come from the patients' own environment.

The *Streptococcus pyogenes* phlegmon described in this article may be compared to a similarly serious infection which is fasciitis necroticans. This is a purulent infection spreading out along the fascia, causing necrosis of the adjacent soft tissues and muscles due to thrombosis in small skin vessels (arterioles). The *Streptococcus pyogenes* organism is typically responsible for this infection (and less commonly *Staphylococcus aureus*). The disease begins rapidly and its course is impetuous, quickly involving large tissue parts and causing a serious septic systemic reaction. It presents mostly in the limbs and originates from small, apparently innocent, usually neglected

wounds and epidermal abrasions. Predisposing factors are similar to those reported earlier: diabetes, old age, chronic alcoholism, immunodeficiency and HIV infection. The rules of diagnosis and management are roughly similar to those presented in this article.

The problem presented in this article is becoming more of an issue as patients with upper limb phlegmon caused by streptococcus are becoming more common in hospitals. We believe that it is desirable that doctors working in emergency units and surgical admission rooms should be familiar with the basic rules of diagnosing and managing these potentially life-threatening and hand-crippling diseases.

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