

## Original Research Article

# Digital gangrene in patients with sepsis

Archana A. Nema, Jitendra R. Darshan\*, Saumya Iyer

Department of Surgery, SMIMER, Surat, Gujrat, India

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**\*Correspondence:**

Dr. Jitendra R. Darshan,

E-mail: jr\_darshan@yahoo.co.in

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### ABSTRACT

**Background:** Symmetrical peripheral gangrene is a rare condition seen in patients of severe sepsis with hypotension. Gangrene is of dry type, limited to the digits only with all peripheral pulses palpable.

**Methods:** Seven patients of severe sepsis with various etiologies were admitted in surgical ICU. These patients developed symmetrical peripheral gangrene during their stay in SICU at a variable period. Detailed history and case records were studied, and data was analyzed. Review of literature was done and compared with findings of our cases.

**Results:** All seven patients had severe sepsis with disseminated intravascular coagulation and all seven required ventilatory support. Administration of inotropes increased the pace of ischemic process.

**Conclusions:** Anticipation and prompt recognition of this condition can limit the progress of gangrene. Treatment is emphasized on the primary condition with focus on limiting the gangrene by local procedures.

**Keywords:** Gangrene, Necrosis, Sepsis, Symmetrical peripheral gangrene

### INTRODUCTION

Finger and toe gangrene in multiple digits is uncommon. The first description was from 1889 in the "Lancet" where it was named Symmetrical Peripheral Gangrene (SPG). It starts peripherally and progress proximally. If the inciting event continues, the gangrene will progress. Pulses may be normal or not. Thrombi accumulate in the small arteries, not the large ones. This is often a form of "collateral damage" to a devastating life-threatening event. Symmetrical peripheral gangrene (SPG) is a rare but severe complication of disseminated intravascular coagulation (DIC) that frequently accompanies sepsis.<sup>1,2</sup> SPG is characterized by symmetric necrosis of the skin and distal extremities, following which two or more distal sites become gangrenous in the absence of large artery occlusion.<sup>1,2</sup>

We report four cases of symmetrical peripheral gangrene (SPG) in patients of septic shock. In the present cases, peripheral ischemia developed within 48–96 hours of

onset of septic shock, and the ischemic changes gradually progressed to gangrene in digits.

### METHODS

The current study is Prospective Longitudinal Observational. Patients with septicemia due to various reasons, admitted in SICU, who developed ischemic changes in the digits.

Seven patients with underlying sepsis due to various etiologies were admitted in Surgical ICU. Appropriate treatment was administered. All of them were found to be post-operative, with one of them operated outside the institute, requiring ventilatory support with IPPV mode. Inotropes were started in all except one to correct the shock along with broad spectrum antibiotics. Each of them developed ischemic changes in the digits during their stay in SICU. Detailed history elicited, and examination was done, findings were recorded. Complete Blood Count (CBC), Blood C/S, ET swab C/S, FDP

(Fibrinogen Degradation Products), D-dimer, coagulation profile, arterial Doppler and other relevant investigations specific to each patient were done.

Each case was studied in detail and the progress of ischemia/gangrene noted serially every 24 hours. Vitals of the patients, ABG (arterial blood gas) were monitored 6 hourly. TLC (Total Leukocyte Count) was repeated every alternate day or as and when required. Literature was reviewed and results were compared.

## RESULTS

On studying each case in detail, it was observed that all the seven patients were post-operative with one of them operated outside the institute. Broad spectrum antibiotics were started in view of the severe sepsis and all of them required ventilatory support with IPPV mode.

Each patient except for one was found to be in shock (Blood-pressure <90 mmHg) and started on inotropic support. Injection Noradrenalin was started at a low dose of 10 ml/hour and titrated according to blood pressure. Within 24 hours of starting the inotropes, digital cyanosis was observed in the 6 patients with variable no of digital involvement. One of the patients who did not receive NA showed blackening of his left little finger on his 5<sup>th</sup> post-operative day.

The investigations revealed an elevated total leukocyte count, altered coagulation profile, raised FDP and D-dimer, low platelet count suggesting an underlying Disseminated Intravascular Coagulation (DIC) in the background of septicemic shock. Blood culture, throat / ET swabs were sent for culture, but no growth was observed.



**Figure 1: Dry type gangrene, associated with mummification.**

Arterial Doppler of the affected limb was performed which showed normal flow in the major arteries. Noradrenalin was stopped on the same day of observation of ischemic changes and replaced with other inotropic agents.

Appropriate fluid resuscitation, higher antibiotic therapy and cautious use of other inotropes were done. One

patient survived as sepsis was controlled; gangrene got well demarcated and did not progress further. Rest of the patients succumbed to the underlying sepsis as the DIC progressed to ARDS.



**Figure 2: Dry type gangrene, associated with mummification.**



**Figure 3: Dry type gangrene, associated with mummification.**

## DISCUSSION

Symmetrical peripheral gangrene (SPG) is a well-documented but rare clinical syndrome characterized by symmetrical distal ischemic damage leading to gangrene of two or more sites in the absence of large vessel obstruction or vasculitis. The ischemic changes begin distally and may advance proximally to involve a whole extremity. The pathogenesis of SPG may involve the Schwartzman reaction, bacterial endotoxin release, and platelet plugging in peripheral arterioles due to vascular collapse and DIC.<sup>3</sup> A more or less prototypical clinical presentation of SPG in spite of a large number of etiological associations is suggestive of DIC as the final common pathway of its pathogenesis. Patients of any age group can be affected. SPG should be suspected at the first sign of marked coldness, pallor, and cyanosis of the acral parts of the body, as the condition can progress rapidly to acrocyanosis and, if not reversed, frank gangrene.<sup>4</sup> The gangrene is of dry type, associated with mummification (Figure 1,2 and 3), and often leads to amputation. The gangrenous affection is frequently symmetric. Infection is usually absent in the lesional skin.

SPG is associated with intact distal pulses as large vessels are spared. It is caused by DIC, hemodynamic compromise, and sepsis. DIC is involved in up to 85% of cases of SPG.<sup>2</sup> DIC results in intravascular thrombosis and infarction of the skin and distal extremities. The resulting state of low blood flow results in thrombotic occlusion of the microcirculation of the affected extremities. The use of vasopressors is simultaneously involved in spasm of the vessels and aggravation of the microcirculation.<sup>5</sup> Pathologic examination of amputated specimens often reveals thrombi concentrated in the small vessels and not the large vessel.<sup>6</sup>

Management of DIC was guided by basic tests of coagulation. If bleeding was the predominant feature, depleted coagulation factors were replaced. On the other hand, in cases where thrombosis was predominant, anticoagulants were administered. Large vessel occlusion or vasculitis is not present with SPG; however, it is important to diagnose the presence of compromised blood flow to the extremities. There is currently no specific prevention and treatment for SPG. Approximately, more than half of the patients that recover from SPG require amputation of the affected limb.<sup>2</sup> Amputation was not required in our patients as there was no secondary infection. Amputation should be considered only after the patient's condition improves and the gangrenous areas become demarcated.<sup>7</sup>

Therefore, disseminated intravascular coagulation should be corrected as appropriate; its cause should be found out and treated aggressively.<sup>8</sup> Use of heparin has not been proven to improve survival. Randomized trials failed to show any encouraging results regarding use of antithrombin. Recombinant activated protein C, plasmapheresis, intravenous immunoglobulin, continuous plasma ultra-filtration, and continuous veno-veno hemofiltration have also been used with variable success rate.<sup>8</sup>

Other measures that might be helpful are sympathetic blockade in the form of ganglion block or intravenous trimethaphan therapy, intravenous nitroprusside therapy, topical nitroglycerine ointment, local or intravenous infusion of an  $\alpha$ -blocker (phentolamine, chlorpromazine), and intravenous infusion of prostaglandin (epoprostenol).<sup>3,5,7,9</sup> Papaverine, reserpine, streptokinase, dextran, and hyperbaric oxygen therapy have not been shown to be beneficial.<sup>3</sup>

The addition of oral corticosteroids is also not of help.<sup>10</sup> Rarely, treatment has been shown to prevent progression or to reverse incipient gangrene.<sup>10</sup> Inter-digital padding and protection from trauma may also decrease tissue injury.<sup>7</sup> Amputation of the gangrenous areas may be inevitable, but initially a nonsurgical approach to management is preferred to allow time for the patient's condition to stabilize and to allow the gangrene to become demarcated.<sup>7,10</sup> Later on, skin grafting may be needed. The degree of gangrene may be less extensive

than expected initially. Meticulous, supportive management is also of paramount importance. Therefore, early physiotherapy was started to restore joint mobility and range of motion.

SPG is usually observed as a complication of various infective diseases. Meningococci, Pneumococci, E. coli, Pseudomonas and Klebsiella have been identified as causative factors.<sup>3</sup> However in our cases, no growth was observed indicating a good antibiotic coverage. Intravenous fluid and appropriate parenteral antibiotics should be started early.<sup>5,8</sup> Vasopressor agents, commonly used in the management of sepsis-induced hypotension, may aggravate this condition.<sup>5</sup>

The treatment priority is usually the underlying condition and detecting DIC; therefore, SPG is typically not treated immediately, instead early control of sepsis and timely recognition of DIC is essential as in our patients. Identification and treatment of the underlying cause is the most important part of the treatment.

## CONCLUSION

SPG is a clinical syndrome of sinister prognostic implication in terms of loss of life or limbs. DIC is an almost universal finding and is probably the final common event in the micro vascular insult that gives rise to the prototypical clinical features of this syndrome in the backdrop of septicemic shock. The rarity of this condition has precluded controlled clinical trials; identification and treatment of underlying etiological factors treatment of DIC and control of sepsis have remained the mainstays of management. Awareness of the condition and prompt recognition may go a long way in early institution of multidisciplinary care for the patients. Further works, preferably collaborative multicenter studies, are needed to clarify the pathogenesis and formulate rational treatment guidelines.

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