CASE REPORT

Multifocal necrotising fasciitis and septic shock complicating varicella infection in an adult

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SUMMARY

A 35-year-old woman with a 3-day history of chickenpox, presented to the hospital in septic shock and with multifocal, non-adjacent lesions of necrotising fasciitis. Necrotising fasciitis is a rare yet life-threatening complication of chickenpox. Blood cultures and wound swabs confirmed the presence of *Streptococcus pyogenes*. The initial emergency management included oxygen, aggressive fluid resuscitation and antimicrobial therapy. Once the patient was stabilised, surgical management ensued. This included debridement and eventual grafting of the necrotic skin lesions. Intensive management and follow-up for 8 weeks were required before the patient was deemed fit for discharge.

BACKGROUND

The case highlights the importance of recognising uncommon, yet life-threatening complications of chickenpox. Although chickenpox is generally considered to be a mild infection, complications may occur and thus, prompt recognition and intervention can be life-saving.

CASE PRESENTATION

A 35-year-old woman with a 3-day history of chickenpox was admitted to the emergency department, in septic shock following the development of multiple painful indurated, haemorrhagic lesions with necrotic centres. The patient had lesions on the right side of the neck, lower abdomen, lower back and left thigh, ranging from 3 to 45 cm in diameter. The necrotic centres had ill-defined margins with juxtaposed areas of hypoperfused tissue extending deep into the subcutaneous tissue. She also had typical vesicular lesions of chickenpox (figures 1 and 2).

In addition, the patient had multiple bouts of diarrhoea and episodes of vomiting.

The patient was running a temperature of 39°C, had an unrecordable blood pressure, a pulse of 150 bpm and tachypnoea at 21 breaths/min.

The patient had no significant medical or surgical history.

INVESTIGATIONS

A complete blood count showed a white cell count $2.9 \times 10^9/L$ (normal values $3.5\text{--}11 \times 10^9/L$) and a platelet count $135 \times 10^9/L$ (normal values $140\text{--}400 \times 10^9/L$). C reactive protein was elevated; 216 mg/L (normal values 0–10 mg/L). Blood cultures revealed the presence of *Streptococcus pyogenes*, while a wound swab grew *S pyogenes*, as

Figure 1 Necrotic lesion on the lower abdomen on admission. Typical vesicular lesions of chickenpox are also evident.

well as two strains of methicillin-resistant *Staphylococcus aureus* (figure 3).

The patient was anuric with a serum creatine of 189 $\mu\text{mol/L}$ (normal values: 44–80 $\mu\text{mol/L}$). Arterial blood gas analysis revealed metabolic acidosis with pH 7.22 (normal values: 7.35–7.45), pCO_2 41.9 mm Hg (normal values 35–45 mm Hg), HCO_3^- 17.3 mmol/L (normal values 22–28 mmol/L), base deficit –10 mmol/L (normal values –2 to +2 mmol/L) and a serum lactate 9.8 mmol/L (normal values 0.4–1.4 mmol/L).

An ultrasound of the neck lesion revealed subcutaneous oedema extending into the deep soft tissues. Enlarged inflammatory lymph nodes were present throughout the neck, with those around the lesion being more prominent.

Figure 2 An image showing the multifocal necrotic lesions (lower abdomen and left thigh).

To cite: Mifsud S, Schembri EL, Mallia Azzopardi C, et al. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2013-201984

Figure 3 *Streptococcus pyogenes* grown from blood cultures.

She was hypokalaemic with a potassium level of 3.35 mmol/L (normal values 3.5–5.1 mmol/L). Stool cultures were negative.

Other investigations included liver function tests, an antero-posterior radiograph of the chest, and an ECG, all of which were unremarkable.

TREATMENT

The patient required immediate management of septic shock and treatment of necrotising fasciitis and chickenpox.

Management of septic shock

Since shock is associated with organ hypoperfusion, resuscitation with crystalloid and colloid fluids was required. In this case, the patient received 1 L of Hartmann's solution within 30 min of her admission. The intravenous fluid infusions managed to raise the central venous pressure (CVP) to 14 mm Hg, but the patient's mean arterial pressure (MAP) remained low (56 mm Hg). For this reason, vasopressors in the form of intravenous norepinephrine 0.77 µg/kg/min and intravenous epinephrine 0.13 µg/kg/min were given and the patient's MAP was raised to 100 mm Hg. This is in concordance with the Surviving Sepsis Campaign Guidelines.¹ Following the administration of the vasopressors, the patient was given both crystalloid and colloid fluid infusions at 30 min intervals.

Figure 4 Granulation tissue formation on lower abdominal lesion following debridement.

Ventilatory support was initially given through a non-rebreather mask. However, since the patient remained tachypnoeic, it was decided to intubate and mechanically ventilate the patient.

The patient was given low-dose hydrocortisone (50 mg twice daily) intravenously since, although her CVP and MAP had been corrected, she was still anuric and therefore did not reach the goals of initial resuscitation. This is in line with the Surviving Sepsis Campaign Guidelines.¹ Following the administration of the above measures, the patient became haemodynamically stable and her renal function improved.

Hypokalaemia was corrected with potassium supplements.

Tight glycaemic control was achieved through blood glucose monitoring and intravenous insulin. Insertion of a nasogastric tube and administration of a high protein feed was required so as to maintain enteral cell nutrition and health.

Management of chickenpox and necrotising fasciitis

Intravenous aciclovir 300 mg 8 hourly was given to treat the underlying varicella infection.

The patient was started on a combination of piperacillin/tazobactam 225 mg 6 hourly intravenously, vancomycin 1 g 24 hourly intravenously and rifampicin 300 mg 8 hourly intravenously within 30 min of arrival to the emergency department after blood cultures were taken. The dosing was adjusted to take into consideration the patient's renal dysfunction.

A day following admission, a necrectomy of the lower abdomen, lower back and left thigh lesions was carried out down to viable pink dermis.

Following the issuing of the blood and wound swab culture and sensitivity results, benzylpenicillin and clindamycin replaced the previous antimicrobial therapy.

Over the following weeks, the patient had to undergo multiple episodes of skin and subcutaneous tissue debridement.

Negative pressure wound therapy (NPWT) was applied to the left thigh and lower back wounds since these were deemed to be the deepest lesions. By creating an airtight seal around the wound, NPWT helps to increase the rate of granulation tissue formation. This was carried out once the wound swab results were negative and after the wound was checked for the presence of any exposed neurovascular structures. If the latter were present, NPWT could have led to bleeding or injury complications (figure 4).

Once the lesions were deemed to be clean and granulating, split-thickness skin grafts were applied. The split-thickness skin grafts were passed through a skin graft mesher so as to fenestrate and expand the grafts. This process helps to allow fluids to drain from underneath the graft easily while at the same time increasing the surface area by which the graft adheres to the underlying tissues.

OUTCOME AND FOLLOW-UP

The patient made steady progress after multiple debridements and skin grafting, and was discharged completely asymptomatic after 8 weeks.

The patient will have regular follow-up outpatient appointments.

DISCUSSION

Chickenpox is an infection caused by the varicella zoster virus, and usually lasts 10 to 15 days. It is generally a mild self-limiting disease. Despite this, chickenpox can be very serious, sometimes even fatal, since it can be associated with many complications, skin and soft tissue infections being one of the most common.²

Although chickenpox is more common in childhood,^{3 4} when acquired during infancy or adulthood, the risk of complications is greater.⁵ In this case the patient was 35 years of age and was thus at an increased risk of suffering from severe complications. Another risk factor for complicated chickenpox is being immunocompromised.⁵ Necrotising fasciitis is one of the rarer complications of chickenpox. In one study, necrotising fasciitis occurred in 1.3% of chickenpox patients.⁶

It is important to note that the complications of chickenpox, minor or severe, can be avoided by immunisation with the chickenpox live-attenuated vaccine. The "Immunisation against infectious disease" recommends that children from 1 year of age or older and adults should receive two doses of varicella vaccine, 4–8 weeks apart (and certainly not less than 4 weeks apart).⁷

Several studies have proved that the vaccine is extremely effective; in one such study the incidence of chickenpox fell by 93%.⁸ In this study, the vaccine was universal and hence reduced the incidence of chickenpox in vaccinated as well as unvaccinated individuals, through herd immunity. Studies suggest that the two-dose vaccination provides different protection in children and adults, 98% and 75%, respectively.^{9 10} However, in all age groups, if an immunised individual does contract varicella, the varicella lesions are usually fewer with less systemic upset, when compared to unvaccinated individuals.⁷

Necrotising fasciitis destroys the deep layers of the skin and subcutaneous tissues. It can be caused by various organisms, *S pyogenes* being one of the most common causative agents. Such organisms could gain entry through a break in the skin, in this case the chickenpox lesions must have been the portal of entry.

Necrotising fasciitis is classified into

- ▶ Type 1 (polymicrobial infection with aerobic and anaerobic bacteria);
- ▶ Type 2 (monomicrobial infection with group A *Streptococcus* occasionally accompanied by *Staphylococcal* infection);
- ▶ Type 3 (Gram-negative monomicrobial infection);
- ▶ Type 4 (fungal infection).

Blood cultures from the patient revealed the presence of *S pyogenes* with *S pyogenes* and methicillin-resistant *S aureus* being grown in the wound swab; hence, implying that this patient's necrotising fasciitis was type 2. This is also supported by the multifocality of the lesions.¹¹ The patient's multifocal presentation made this case even rarer.

Necrotising fasciitis requires a high index of clinical suspicion as early recognition may be clinically difficult. In order to help clinicians in differentiating necrotising fasciitis from other soft tissue infections, the Laboratory Risk Indicator for Necrotising Fasciitis (LRINEC) score can be utilised. The LRINEC score utilises six serological markers, these being: total white cell count, haemoglobin, sodium, serum creatine, blood glucose and C reactive protein. If the LRINEC is equal to or greater than 6, necrotising fasciitis should be seriously considered.

From the results shown in table 1, this patient had a total LRINEC score of 9 suggesting that the diagnosis of necrotising fasciitis was highly likely. Such scores can be used as a diagnostic adjunct given the difficulty of recognising early necrotising fasciitis. A retrospective observational study concluded that the LRINEC score is a score capable of detecting even clinically early cases of necrotising fasciitis.¹³ However, another study contradicted this fact, stating that 43.3% of patients with clinically early necrotising fasciitis had an LRINEC score of less than 6.¹⁴ Another study includes a patient with an LRINEC score of 0,

Table 1 Laboratory risk indicator for necrotising fasciitis score

Serological marker	Values ¹²	Points	Patient's marker levels	Patient's LRINEC score
Total white cell count	<15×10 ³ /mm ³	0	2.9×10 ³ /mm ³	0 points
	15–25×10 ³ /mm ³	1		
	>25×10 ³ /mm ³	2		
Haemoglobin	>13.5 g/dL	0	9.8 g/dL	2 points
	11–13.5 g/dL	1		
	<11 g/dL	2		
Sodium	≥135 mmol/L	0	136 mmol/L	0 points
	<135 mmol/L	2		
Serum creatinine	≤141 μmol/L	0	189 μmol/L	2 points
	>141 μmol/L	2		
Blood glucose	≤10 mmol/L	0	14.7 mmol/L	1 point
	>10 mmol/L	1		
C reactive protein	<150 mg/L	0	216 mg/L	4 points
	>150 mg/L	4		

who was later diagnosed with necrotising fasciitis at surgery.¹⁵ These studies imply that although the LRINEC score can be used as an adjunct to clinical suspicion to diagnose necrotising fasciitis, high clinical suspicion remains the best and most reliable indicator for the diagnosis.

Following its diagnosis, necrotising fasciitis requires urgent aggressive management due to its rapid progression. A delay in recognising and treating necrotising fasciitis is associated with a higher mortality rate.¹⁶ In this case, the patient deteriorated rapidly, developing septic shock within 6 h of noting the haemorrhagic lesions. Patients with necrotising fasciitis and shock at presentation are at an increased risk of mortality.¹⁷

Septic shock is defined as a systemic inflammatory response syndrome (evidenced by low white cell count and raised temperature) in the presence of an infection (*S pyogenes* grown in blood and wound swab cultures) and dysfunction of an organ system (renal failure and lactic acidosis) with hypotension despite adequate fluid resuscitation, requiring vasopressors to restore the circulation.

Effective management of invasive *S pyogenes* infections includes early diagnosis and rapid management with general supportive measures and antimicrobials.¹⁸

Prompt and intensive early goal-directed therapy is paramount in the management of septic shock. The Rivers Trial demonstrated that early goal-directed therapy before admission to the intensive care unit in the treatment of septic shock, optimised the patients' condition and reduced the mortality rate.¹⁹ Furthermore, a separate study revealed how the duration of hypotension was found to be the main determinant of survival in patients with septic shock.²⁰ Figure 5 illustrates the trend in systolic and diastolic blood pressures from unrecordable to 116/92 mm Hg in this patient within an hour from admission, with a corresponding trend in the MAP.

Guidelines recommend that empirical antimicrobial therapy is to be started within 1 h of the patient's admission if the patient is diagnosed with septic shock, as failure to do this, is associated with a higher mortality rate.¹ In fact a study by Kumar *et al*,²⁰ revealed how each hour of delay in antimicrobial administration, over the first 6 h after documented hypotension, was associated with a decrease in survival by 7.6%. Since the causative organism/s is/are unknown, the empirical antimicrobial therapy has to cover Gram-positive, Gram-negative and anaerobic bacteria as well as consider the presence of resistant bacteria. For this

Figure 5 Blood pressure and mean arterial pressure monitoring.

reason, piperacillin/tazobactam was used to cover Gram-positive organisms especially streptococci, Gram-negative organisms and anaerobes. Vancomycin was used to cover Gram-positive bacteria and the possibility of methicillin-resistant *S aureus* while Rifampicin was used for its Gram-positive cover and excellent penetration into soft tissue. Once the causative organism was identified, the antimicrobial regimen was deescalated to clindamycin and benzylpenicillin. Benzylpenicillin may not be adequate to treat severe streptococcal infections, hence implying the need for clindamycin.²¹

The definitive treatment of necrotising fasciitis includes the aggressive debridement of all the necrotic and poorly perfused tissues. Non-adherent gauzes impregnated with an antiseptic were applied to the debrided lesions which were then covered with dry dressings. During this time, daily inspections were carried out to assess tissue viability and evidence of infection.

The wounds were eventually closed with split-thickness skin grafts. Split-thickness skin grafts were utilised as they are more easily available and have a better graft take due to their low metabolic needs when compared to full thickness skin grafts.²²

Learning points

- ▶ Necrotising fasciitis is a clinical diagnosis, hence requiring a high index of clinical suspicion.
- ▶ Necrotising fasciitis cannot be managed by intravenous antibiotics alone. Since the infected areas become hypoperfused and necrosed, antibiotic delivery is insufficient to eradicate the bacteria. Hence; this implies the need for surgical debridement.
- ▶ Although chickenpox may be considered a minor infection, it can have devastating complications and may even be fatal. This can be prevented by vaccination.

Acknowledgements The authors would like to thank Dr Stephen Sciberras, consultant in Anaesthesia and Intensive Care at Mater Dei Hospital, for his contribution to this case report and Mr Brian Cassar at the Medical Illustration Unit at Mater Dei Hospital for his professional images.

Contributors SM and ELS were responsible for literature review and manuscript preparation. CMA and MAZ contributed towards editing and review of the final manuscript.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Commissioned; internally peer reviewed.

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