Necrotizing soft tissue infection of the right anterolateral abdominal wall caused by a ruptured gangrenous appendix in an elderly diabetic patient

Infezione necrotizzante dei tessuti molli della parete addominale anterolaterale destra causata da rottura di appendice gangrenosa in un paziente diabetico anziano

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INTRODUCTION

N ecrotizing soft tissue infections (NSTIs) of the abdominal wall usually occur when either a common superficial soft tissue infection progresses down to or an injury (*e.g.*, knife stab) penetrates the investing muscle fascia or an intraabdominal infection spreads directly to the muscle layers of the abdominal wall. These infections are severe and associated with significant morbidity and mortality. Risk factors such as diabetes mellitus, prior infection, age >65 years, chronic cardiorespiratory and renal disease and immunosuppression are usually met in this group of patients [1]. Herein, we present an elderly female patient with a severe NSTI of the abdominal wall due to a ruptured gangrenous appendix.

CASE REPORT

We present a case report of an 83-year-old female patient who was admitted to the emergency department of our hospital complaining for right abdominal pain for the past two days. Initially it was attributed to a fall to the floor. However, after

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a more detailed history, the patient had this pain for 4 weeks. Moreover, she had been receiving oral antibiotics (2nd generation cephalosporin) for 6 days prior to her admission for what was supposedly a minor superficial skin infection attributed to her subcutaneous use of insulin. Her past medical history included insulin-dependent diabetes mellitus, chronic obstructive pulmonary disease, atrial fibrillation, chronic renal failure and morbid obesity (body mass index, BMI=59). On admission she exhibited signs of agitation and dyspnea with hypotension and tachycardia (systolic arterial pressure 90 mmHg, heart rate >110 bpm, oxygen saturation 88%). Furthermore, she had a tender right abdomen but without any demonstrable pathology on her skin or crepitus (Figure 1). Arterial blood gases revealed metabolic acidosis and hypoxaemia (pH=7.301, pO₂=55.4 mmHg, pCO₂=39.9 mmHg, Base Deficit=6.2 mmol/L). Laboratory tests showed leukocytosis (WBC count 45.000/mm³), anaemia (Hct 26%, Hgb 9 g/dl), C-reactive protein 221 mg%, hyperglycaemia (Glucose 334 mg%), acute on chronic renal failure (Cr 4.3 mg%, Urea 152 mg%) and hyponatraemia (Na=110 mEq/L). An abdominal computed tomography (CT) scan demonstrated signs of infection of the entire right anterolateral abdominal wall (muscle and fascial oedema and most notably extensive presence of gas between all wall layers) and the overlaying subcutane-



Figure 1 - The skin of the involved area without any classical signs of inflammation.



Figure 2 - Abdominal CT demonstrating muscle and fascial oedema of the entire right anterolateral abdominal wall, along with marked presence of gas. There is also oedema of the overlying subcutaneous fat, as well as presence of gas.



Figure 3 - Abdominal CT showing mild stranding of the peritoneal fat anteriorly to the cecum.



Figure 4 - Necrotic appearance of subcutaneous fat and fascia.

ous fat (oedema and presence of gas), along with mild stranding of the peritoneal fat anteriorly to the cecum -without any marked intra-abdominal pathology (Figures 2 and 3). A necrotizing soft tissue infection was suspected and a LRINEC score was calculated (http://www.mdcalc.com/lrinecscore-for-necrotizing-soft-tissue-infection/) to be 13 with a positive predictive value of 93,4%.

The patient was subsequently taken to the operating room and appropriate antibiotics were administered (piperacillin/tazobactam 4.5g & clindamycin 1.2 g, bolus). She underwent an aggressive necrosectomy of all the involved layers of the right anterolateral abdominal wall sparing the peritoneum starting from the subcutaneous fat down to her peritoneum (Figures 4 and 5). The peritoneum was healthy except an area in the right lower quadrant where inflammatory induration warranted further exploration. After entering her abdomen, a gangrenous appendix was found in front of the cecum and strongly attached to the parietal peritoneum (Figure 6) without



Figure 5 - Intraoperative photograph showing the defect left after aggressive necrosectomy of all the involved layers of the right anterolateral abdominal wall sparing the peritoneum.



Figure 6 - Intraoperative photograph showing the ruptured gangrenous appendix without any signs of peritonitis.



Figure 7 - Closure of skin flaps with negative pressure drains.

findings of surrounding peritonitis. An appendectomy was carried out and the peritoneum was closed. After placing negative pressure drains the skin flaps were closed with heavy sutures (Figure 7). The patient was transferred intubated to the ICU and died the next day due to multiple organ failure. Cultures of the abdominal wall necrotic and septic tissues revealed a polymicrobial infection (three microorganisms): *Morganella morganni*, *Serratia marcescens*, and *Enterococcus avium*.

DISCUSSION

Necrotizing soft tissue infections (NSTIs) involve the skin, subcutaneous tissue, fascias and muscles and have a substantial morbidity and mortality ranging from 30 to 70% depending on whether the first surgical debridement is timely or not, respectively [2, 3]. The prompt and aggressive surgical debridement with removal of all necrotic tissues (even suspicious or borderline ones) is the sole and most important factor affecting the clinical course of such patients, regardless of the infection's localization or the causative microorganisms. This requires an early diagnosis and a high index of suspicion. In our case, the risk factors of the patient (age, diabetes mellitus, chronic cardiorespiratory and renal disease), previous antibiotic administration for a minor infection of the skin and the complaint of severe abdominal pain which was disproportionate to the clinical findings, prompted us to investigate the high possibility of an underlying NSTI. We would like to emphasize the significance of uncontrolled diabetes mellitus as a precipitating factor for development of complicated surgical infections in any site where skin barrier is disrupted (as in the diabetic foot or iv drug abusers) or an adjacent infectious disease process is initiated (as is the case of our patient).

Clinical features of NSTIs include sudden onset of symptoms, rapid deterioration of the patient and progressive involvement of many tissue planes. The presence of gas in the tissues, found clinically as skin crepitus, is not characteristic of all NSTIs. The skin may not be involved in the early phase with absence of the classical signs of inflammation, as was seen in our patient. Measurement of the laboratory risk indicator for necrotizing infections (LRINEC) proposed by Wong et al. is used as a risk tool for predicting the probability of having a necrotizing infection. It is easily calculated in daily clinical practice, based on readily available laboratory values each of which has specific number of points, as follows:

Variable LRINEC score Points:

- C-reactive protein \geq 150 mg/l (4 points)
- White blood cell count (cells/mm³) 15–25 (1 point); >25 (2 points)
- Haemoglobin level (g/dl) 11–13.5 (1 point); <11 (2 points)
- Sodium level <135 mmol/l (2 points)
- Creatinine level >1.6 mg/dl (2 points)
- Glucose level >180 mg/dl (1 point)

LRINEC score ≤5 points indicates a low risk (<50% probability) of necrotizing infection; 6-7 points indicate an intermediate risk (50-75% probability), ≥8 indicates a high risk (>75% probability). Thus, a score >6 points is suspicious for a necrotizing infection and >8 points is highly predictive. An online calculator is available at the following link: http://www.mdcalc.com/lrinec-score-for-necrotizing-soft-tissue-infection/.

Radiological studies, such as plain radiographs and computed tomography, usually help the surgeon to determine the presence of gas and/or muscle involvement and to locate the infection and its extent, in order to plan his operation. In our case, we were surprised that abdominal CT demonstrated an extended involvement of the entire right anterolateral abdominal wall, which was very important for our approach. Thus, the incision extended vertically from the right costal margin to the right inguinal area. During the procedure itself, the surgeon must take into consideration the patient's life only and should not hesitate to proceed to more aggressive debridement if he deems it necessary irrespective of the reconstruction that will be necessary in the future [2, 3]. All necrotic tissue and those which are borderline must be excised irrespective of the defect left behind. In our case all layers of the abdominal wall were excised, except the peritoneum which was intact.

NSTIs affecting the abdominal wall have been previously reported and some have been attributed to intra-abdominal pathology, such as appendicitis (ruptured gangrenous, in inguinal or Spigelian hernia sacs, etc), perforated cecum carcinoma, or even in retroperitoneal conditions, such as rupture of a stromal tumor [5-9]. Abdominal wall NSTIs are seen postoperatively after contaminated operations and are manifested as infection of the peri-incisional area or tissues surrounding colostomies or even port insertion sites [10-12]. The cornerstone of treatment is aggressive necrosectomy of the involved tissues with the adjunct of proper antibiotics and the support of patient's organs and systems in an intensive care unit.

In conclusion, abdominal wall NSTIs are secondary infections due to intra-abdominal or retroperitoneal infections with high morbidity and mortality. Severe symptoms disproportionate to lesser clinical findings in patients with appropriate risk factors should warrant immediate investigation for an underlying NSTI. Prompt aggressive necrosectomy of all involved tissues is the cornerstone of treatment irrespective of the reconstruction which will be carried out if the patient survives.

Keywords: necrotizing soft tissue infections, abdominal wall, appendicitis.

SUMMARY

Necrotizing soft tissue infections (NSTIs) of the abdominal wall usually occur when either a common superficial soft tissue infection progresses down to, or an injury (e.g. knife stab) penetrates, the investing muscle fascia, or an intra-abdominal infection spreads directly to the muscle layers of the abdominal wall. These infections are severe and associated with significant morbidity and mortality. We present an 83-yearold female diabetic patient who was admitted to the surgical emergency department complaining of right abdominal pain after a fall to the floor. She had previously received oral antibiotics for a minor superficial skin infection attributed to her subcutaneous use of insulin. On admission she exhibited signs of agitation and dyspnoea with hypotension and tachycardia (systolic arterial pressure 90mmHg, heart rate >110 bpm, oxygen saturation 88%). Furthermore, she had a tender right abdomen but without any demonstrable pathology on her skin or crepitus. Arterial blood gases revealed metabolic acidosis and hypoxaemia. An abdominal computed tomography (CT) scan demonstrated signs of infection of the entire right anterior abdominal wall and the LRINEC score was calculated to be 13. Subsequent operative aggressive necrosectomy of all the involved layers of the right anterolateral abdominal wall sparing the peritoneum was undertaken. Unfortunately, the patient died the next day due to multiple organ failure.

RIASSUNTO

Le infezioni necrotizzanti dei tessuti molli (NSTI) della parete addominale si verificano generalmente in conseguenza della progressione profonda di un'infezione dei tessuti molli superficiali o della penetrazione di una lama (ad es. una coltellata) nella fascia muscolare o dell'estensione diretta di un'infezione intraddominale agli strati muscolari della parete addominale. Queste infezioni sono gravi e sono associate a morbilità e mortalità significative. In questo articolo presentiamo il caso di una donna diabetica di 83 anni giunta alla nostra osservazione, presso il dipartimento di chirurgia d'urgenza, lamentando dolore addominale in sede destra conseguente a una caduta sul pavimento. In precedenza, aveva effettuato terapia antibiotica orale per un'infezione cutanea superficiale attribuita ad iniezione di insulina per via sottocutanea. Al ricovero, la paziente presentava segni di agitazione e dispnea con ipotensione e tachicardia (pressione arteriosa sistolica 90mmHg, frequenza cardiaca >110 bpm, saturazione O_2 88%). Inoltre, presentava un addome destro dolente ma senza alcuna evidenza di patologia cutanea o crepitio. L'emogasanalisi evidenziava acidosi metabolica e ipossiemia. Una tomografia computerizzata addominale (CT) indicava segni di infezione dell'intera parete addominale anteriore destra e il punteggio LRINEC era pari a 13. Veniva quindi effettuata una necrosectomia chirurgica aggressiva di tutti gli strati interessati della parete addominale anterolaterale destra risparmiando il peritoneo. Purtroppo, una sindrome da disfunzione multiorgano ha poi determinato il decesso della paziente il giorno successivo.

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