METHICILLIN-RESISTANT STAPHYLOCOCCUS EPIDERmidIS INFECTION INSENSITIVE TO TEICOPLANIN.
A CASE REPORT AND A REVIEW OF THE LITERATURE

Keramidas E., Rodopoulou S., Iconomou T., Tsati E., Ioannovich J.

Department of Plastic Surgery, Microsurgery and Burns Unit, G. Gennimatas General Hospital of Athens, Athens, Greece

SUMMARY. High-voltage electrical injuries are unique with respect to long-term morbidity and overall outcome. Depth of injury and potential complications are related to the intensity of the current that passes through the patient. Necrotic tissue located on the skin or in the muscles, nerves, and vessels offers a favourable environment for the development of serious infections caused by various bacteria. A patient who developed septic shock from a methicillin-resistant Staphylococcus epidermidis (MRSE) resistant to teicoplanin, following a serious high-voltage electrical injury, is presented. Coagulase-negative staphylococci are now increasingly recognized as nosocomial pathogens. MRSE is broadly recognized to be sensitive to glycopeptide treatment. MRSE resistant to teicoplanin and vancomycin has already been reported in the literature in a few patients but not after a burn injury.

Introduction

The prevalence of Gram-positive pathogens in bacteremia has increased over the past 20 years, mainly because of the increased isolation of coagulase-negative staphylococci (CNS) and enterococci. Between 35 and 66% of clinically important CNS are currently resistant to methicillin. Vancomycin and teicoplanin have become the first-choice antibiotics for these resistant pathogens. Resistance to vancomycin and teicoplanin is rare. However, as their use has gradually expanded, an increase of pathogens resistant to these antibiotics is to be expected.

We present a patient who sustained a severe electrical injury and developed septic shock caused by CNS resistant to teicoplanin but sensitive to vancomycin.

Case report

A previously healthy 40-yr-old male sustained a high-voltage electrical burn injury at work. He was transferred to our hospital immediately. On arrival at the emergency department he was estimated to have an 8% TBSA full-thickness burn involving the hands, wrists, and part of the forearms. Both hands and forearms were already in a Volkmann contraction position. The patient was alert and the rest of his physical examination was normal.

On the day of admission, escharotomies and fasciotomies of both forearms and hands were carried out, combined with carpal tunnel release. Serial surgical debridement of both wrists was performed within the following days excising necrotic flexor tendons, muscles, and the ulnar vessels. A large part of the median and ulnar nerves bilaterally was destroyed and excised at wrist level. Debridement was followed by daily local wound care. Methicillin-resistant Staphylococcus aureus (MRSA) was identified in the wounds and subsequently treated with i.v. administration of teicoplanin 400 mg ¥ 2. The patient's general condition was stable and satisfactory.

Following debridement, an extensive defect of 12 ¥ 3 sq cm and deep to the pronator quadratus muscle was left. The extensor compartments of the wrist and the flexors carpi radialis and ulnaris, as well as the radial arteries bilaterally, appeared to be intact.

On post-burn day 20, the patient underwent coverage of both wrist defects with pedicled groin flaps. His post-operative course was uneventful until post-operative day 4 (post-burn day 24), when he started to be febrile. He rapidly developed cellulitis of the abdominal wall around the groin flaps, which extended to the anterior left upper thigh. Although aggressive local care was applied to all wounds daily and antibiotics were administered i.v according
to the wound cultures (teicoplanin 400 mg ¥ 2 and aminoglycoside 150 mg ¥ 2), the patient deteriorated progressively. On post-op day 9 (post-burn day 29) he suffered acute kidney and lung failure. The groin flaps were immediately detached from the wrists and the patient was intubated and maintained under mechanical ventilation (Fig. 1). The blood cultures confirmed septicaemia due to a methicillin-resistant (MRSE) resistant to teicoplanin and sensitive to vancomycin.

The patient remained in a critical condition under aggressive antibiotic therapy (vancomycin 500 mg ¥ 4 and aminoglycoside 150 mg ¥ 2) and local wound care for the next 12 days (post-op day 21, post-burn day 33), when he developed clinical signs of acute abdomen. Ultrasound and CT scan of the abdomen revealed a large quantity of fluid in the peritoneal cavity and spleen infarcts with local abscess formation. The patient underwent laparotomy and subsequently splenectomy, plus the removal of almost 5 l of fluid from his abdomen. The spleen pathology confirmed the pre-operative diagnosis as the spleen was completely infiltrated with septic infarcts (Fig. 2). During the post-splenectomy period the patient started to improve gradually, but he remained intubated under ventilation until post-burn day 70.

The burn wounds healed with granulating tissue formation in both wrists. The remnants of the groin flaps were surgically excised and the overlying skin was harvested as a full-thickness skin graft to cover the wrist defects temporarily. The patient started intensive physical therapy on his hands and on post-burn day 90 he was discharged in a good general condition with instructions to continue physical therapy of his hands. He refused further surgical treatment, but he was invited to return after a month's time for further reconstruction of his hands with tendon and nerve grafts.

Discussion and conclusion

The prevalence of Gram-positive pathogens in bacteraemia has increased over the past 20 years, mainly because of the increased isolation of CNS and enterococci. CNS bacteraemia is reported to affect 13.6% of cases. Criteria have been developed to define true bloodstream infections after isolation of CNS.

CNS are now commonly encountered in hospital patients, particularly in infections related to heart valve diseases, intravascular catheters, and neurosurgical and arteriovenous shunts. CNS are also the commonest bacteria responsible for peritonitis in patients undergoing continuous ambulatory peritoneal dialysis.

Hospital isolates are commonly resistant to methicillin. Consequently, glycopeptide antibiotics have become the mainstay of chemotherapy in both CNS and MRSA.

Although almost all Staphylococcus aureus strains and the vast majority of CNS are susceptible to vancomycin and teicoplanin, enterococci resistance is reported to reach 0.6%-13.4% of cases. Glycopeptides exhibit bactericidal activity by inhibition of bacterial cell wall synthesis. Specifically, they act by binding the terminal D-alanyf-D-ala-

Fig. 1 - Extensive defect on palmar surface of right wrist following groin flap debridement.

Fig. 2 - Spleen specimen.
nine of the penta-peptide side chains of growing peptidoglycans. Unfortunately, despite the efficacy of glycopeptides against Gram-positive infections, resistant strains are becoming an alarming problem. Clinical failure of teicoplanin and vancomycin treatment in CNS haemolyticus and Staphylococcus epidermidis and in MRSA in Japan and in the United States has already been reported. Glycopeptide resistance in enterococci has been documented in several countries.

According to the literature, our patient is the first reported to have developed infection from an MRSE resistant to teicoplanin but sensitive to vancomycin following a high-voltage (> 1000 V) electrical injury. Many explanations have been put forward as a basis for staphylococcal glycopeptide resistance but the mechanism remains elusive.

Clinical and experimental data show that vancomycin can be used therapeutically for bacteria with increased teicoplanin minimal inhibitory concentration and vice versa. Teicoplanin and vancomycin can be used alternatively in the treatment of Gram-positive bacterial infections. Teicoplanin is similar in structure and in action mechanism to vancomycin. However, its half-life is longer than that of vancomycin (> 50 h), allowing one dose of teicoplanin daily. The drug is highly protein-bound (> 90%). The typical dose is 6 to 15 mg/kg/day. It can be given i.m. and it has less vestibular toxicity and ototoxicity.

It is also reported that teicoplanin therapy, in serious infections caused by Staphylococcus aureus, can lead to the emergence of strains resistant to teicoplanin. However, these strains remain susceptible to vancomycin. Current therapeutic alternatives to vancomycin are limited. The increasing resistance of Gram-positive bacteria to vancomycin and teicoplanin should be seriously considered in the burn care field and it may become a difficult clinical problem to solve.

RESUME. Les lésions électriques dues à la haute tension sont uniques pour ce qui concerne la morbidité à long terme et le résultat global. La profondeur de la lésion et les possibles complications dépendent de l’intensité du courant qui traverse le patient. Le tissu nécrotique localisé sur la peau ou dans les muscles, les nerfs et les vaisseaux fournit un environnement favorable pour le développement de graves infections causées par diverses bactéries. Les auteurs présentent le cas d’un patient atteint de choc septique provoqué par une grave lésion électrique à haute tension. Aujourd’hui les staphylocoques coagulase-négatif se retrouvent toujours plus fréquemment comme des pathogènes nosocomiaux. Le MRSE est largement reconnu pour être sensible au traitement avec les glycopeptides. Le MRSE résistant à la teicoplanine et à la vancomycine a déjà été décrit dans la littérature dans un certain nombre de cas, mais jamais après une brûlure.

BIBLIOGRAPHY