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CLINICAL INFORMATION

# Alternative approach to autonomic instability of very severe tetanus: stellate ganglion block


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**KEYWORDS**
Sellate ganglion block;
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**Abstract** Tetanus is an acute and deadly disease caused by *Clostridium tetani*. A 60-year-old male came to hospital after he injured his thumb with a knife. Ten days later, he returned to hospital with abdominal spasms. He was vaccinated against tetanus and referred to intensive care unit. As he had sudden difficulty in respiration, he was entubated. Midazolam, magnesium and esmolol infusion were started. Next day, muscle spasms progressed all over his body. Midazolam infusion was replaced with propofol and vecuronium. At the third day, morphine infusion was added. At the 16$^{th}$ day, dexmedetomidine infusion was started. At the 20$^{th}$ day, ultrasound guided stellate ganglion block was performed to denervate sympathetic activity. The block was performed three times in a 10 days period. At the 30$^{th}$, the patient recovered from very severe tetanus. The mainstay of tetanus treatment is adequate sedation. Neuroaxial blocks were proved to be effective for the control of sympathetic overactivity in recent years. Circulatory collapse remains to be the major cause of death. The mechanism is unclear but altered myocardial function is thought to be related to changeable catecholamine levels. The effect of stellate ganglion block on sympathetic and parasympathetic control of heart has been studied since the beginning of 1980s. Recently Scanlon et al. reported they treated a patient with medically refractory ventricular arrhythmias by ultrasound guided bilateral stellate ganglion block. In conclusion, stellate ganglion block can be an alternative method when the autonomic storm cannot be controlled with medical agents.


**PALAVRAS-CHAVE**
Bloqueio do gânglio estrelado;
Tétano;

**Abordagem alternativa para instabilidade autonômica no tétano muito grave: bloqueio do gânglio estrelado**

**Resumo** O tétano é uma doença aguda e fatal causada por *Clostridium tetani*. Um homem de 60 anos de idade deu entrada em nosso hospital depois de ferir o polegar com uma faca. Após

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dez dias, o paciente deu entrada no hospital com espasmos abdominais; foi vacinado contra tétano e encaminhado para a unidade de terapia intensiva. Como apresentava dificuldade súbita na respiração, o paciente foi intubado. Foi iniciada uma de midazolam, magnésio e esmolol. No dia seguinte, os espasmos musculares progrediram para o corpo todo. A infusão de midazolam foi substituída por propofol e vecurônio. No terceiro dia, foi adicionada morfina à infusão. No décimo sexto dia, uma infusão de dexmedetomidina foi iniciada. No 20° dia, o bloqueio do gânglio estrelado guiado por ultrassom foi realizado para dessensibilizar a atividade simpática. O bloqueio foi realizado três vezes no período de dez dias. No 30° dia, o paciente recuperou-se de um tétano muito grave. A base do tratamento de tétano é a sedação adequada. Nos últimos anos, os bloqueios neuraxiais provaram ser eficazes para o controle da hiperatividade simpática. O colapso circulatório continua sendo a principal causa de morte. O mecanismo não está claro, mas acredita-se que a função alterada do miocárdio esteja relacionada com os níveis de catecolaminas mutáveis. O efeito do bloqueio do gânglio estrelado sobre o controle simpático e parassimpático do coração tem sido estudado desde o início da década de 1980. Recentemente, Scanlon et al. relataram o tratamento de um paciente com arritmia ventricular refratária a medicamentos com bloqueio bilateral do gânglio estrelado guiado por ultrassom. Em conclusão, o bloqueio do gânglio estrelado pode ser um método alternativo quando a tempestade autonômica não pode ser controlada com agentes medicamentosos.


## Introduction

Tetanus is an acute and deadly disease caused by neurotoxin of *Clostridium tetani*. Although prevention is possible with widespread vaccination programmer held from infancy to adulthood, it continues to be a life threatening problem in developing countries.[1] Autonomic dysfunction is the most significant cause of death in advanced stages, so control of fluctuations in hemodynamic parameters has vital importance.

In this case report we represented the unusual treatment modality of a patient with very severe generalized form tetanus.

## Case report

A 60-year-old male applied to hospital with a wound at his left thumb. He was injured with the knife of construction equipment. After his wound was cleaned, single dose of penicillin was administered. The patient applied to the hospital with abdominal spasms 10 days later. He was vaccinated against tetanus and referred to intensive care unit. On admittance he was conscious, his orientation and cooperation was intact. There were spasms at his back, abdomen and around his mouth, but there was no muscle rigidity. He had no difficulty in mouth opening, either. His vital signs were completely stable and in normal ranges. He was placed in a dark, isolated room. Tetanus immunoglobulin and metronidazole were administered. His wound was debridated. Only 10 h after his admittance, a refractory hypertension and tachycardia were observed. He had sudden difficulty in respiration, so he was entubated immediately. Midazolam and magnesium infusions were started for sedation. As his hypertension and tachycardia resisted, esmolol infusion was added to the therapy. On the second day, fluctuations in hemodynamic parameters were observed. Muscle spasms progressed all over his body. Midazolam infusion was replaced with propofol and vecuronium. He had cardiac arrest and was resuscitated for 5 min. At the third day, morphine infusion was added to the therapy. Despite an aggressive sedation, his convulsions and muscle spasms continued to be triggered easily. We planned plasmapheresis sessions to decrease the bacterial load in his blood stream. After each session, tetanus immunoglobulin and antibiotic doses were repeated. At the 10th day, we performed percutaneous tracheostomy without any complications. At the 16th day plasmapheresis therapy was ended and dexmedetomidine infusion was started for the control of cardiac storms. Dexmedetomidine managed to stabilize hemodynamic parameters for only 2 days. At the 20th day, ultrasound guided left-sided stellate ganglion blockage was performed in order to block sympathetic activity. 5 mL of 0.5% bupivacaine and 5 mL of isotonic solution applied perpendicular to anterior surface of the sixth cervical vertebrae with anterior paratracheal approach. Two hours later, there was 1.5 °C increase in temperature of left hand and approximately 20% decrease in heart rate. The procedure was repeated 3 times in 10 days. At the 30th day, all of his medications were stopped for assessment of mental state. Neither muscle spasms, nor convulsions occurred. The patient recovered from grade IV tetanus.

## Discussion

The mainstay of tetanus treatment is adequate sedation. Benzodiazepines are GABA-A agonists which indirectly antagonize the effect of tetanus toxin.[1] So midazolam infusion was our first chose at treatment but despite an aggressive sedation protocol with midazolam, propofol, magnesium, morphine and dexmedetomidine respectively, we could not get a satisfactory result.

Circulatory collapse which is the result of autonomic instability remains to be the major cause of death. During autonomic storms, fluctuations are seen from hypertension and tachycardia to a profound depression with hypotension, bradycardia and fall in central venous pressure. The mechanism is unclear but altered myocardial function is thought to be related to raise and sudden withdrawal of catecholamine levels. Epidural and spinal blocks were proved to be effective at sympathetic overactivity control in recent years,[2] so we considered to perform epidural anesthesia. But our patient had obesity, his convulsions and muscle spasms were easy to trigger, so it would be difficult to provide an appropriate position for epidural block performance. Consequently we decided to perform stellate ganglion block (SGB) to control sympathetic activity. The effect of SGB on sympathetic and parasympathetic control of heart has been studied since the beginning of 1980s. In 2008, Yoshimoto et al. studied cardiac effects of stellate ganglion denervation on rats. They showed that following bilateral stellate ganglionectomy or stellate ganglion denervation procedures, the heart rate of rats decreased significantly.[3] It is well known that SGB affects both the sympathetic and parasympathetic nervous systems based on the degree of block. As the efferent sympathetic innervation from stellate ganglion is primarily distributed over the sinus node of the heart, it is not surprising that it may result in heart rate changes. In 2015 Scanlon et al. reported they treated a patient with medically refractory venticular arrhythmias by ultrasound guided bilateral SGB. They stated SGB provided sympathetic blockade which interrupted sympathetic superactivity contributing to ventricular arrhythmias and helped controlling ventricular electrical storm.[4]

Norepinephrine has known cardiostimulatory effects and has shown to be depleted following denervation of stellate ganglion complex. In the study of Yoshimoto et al., level of cathecolamines such as norepinephrine, epinephrine and dopamine markedly decreased in all heart chambers of the rats following stellate ganglionectomy. This result brought the idea that their primary source in the heart was sympathetic nerve terminals.[3] Although this is not the main mechanism of the body to control catecholamine release, we decided to perform SGB as an alternative way to control cardiac storms.

Clinical syndrome of tetanus is caused by tetanospasmin toxin of *Clostridium tetani*. When the toxin load is high, it enters to blood stream and binds to nerve terminals throughout the body.[2] As the toxin is internalized and transported intra-axonally to the cell body, plasmapheresis may seem to be ineffective. Nevertheless in 2007 Rogalewski et al. represented improvement of a patient with advanced postvaccinal demyelinating encephalitis. The patient was given active vaccination with recombinant hepatitis A – and hepatitis B-virus, diphteria, tetanus, and poliovirus antigen in the same day. He had improved with the help of plasmapheresis started even 3 months after the onset of symptoms.[5] We planned five sessions of plasmapheresis for our patient, but the result was not effective enough to control autonomic instability.

In conclusion, tetanus is a preventable disease with high mortality rate. Autonomic disturbances' involving the cardiovascular system is the major problem in very severe cases. Stellate ganglion blockade can be an alternative method when the autonomic storm cannot be controlled with medical agents.

## Conflicts of interest

The authors declare no conflicts of interest.

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