

Case Report

Suicide by Intravenous Injection of Vecuronium Bromide

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ABSTRACT

A case of death due to intravenous self-administration of vecuronium bromide by an anaesthetist is being reported, who was found dead on a sofa in front of the bedroom of her house. Initially during investigation, it was alleged that her husband being an orthopedician may have injected the drug. There was a hue and cry from the relatives of the deceased in this regard, as there had been trivial instances of strained relationship between husband and wife while the latter was alive.

After a magistrate's inquest, a medicolegal autopsy was conducted by the department of forensic medicine of the same medical college hospital where the deceased had been brought. After the autopsy, relevant viscera and blood sample were preserved for chemical analysis. Pieces of vital organs were preserved for histopathological examination. Opinion as to the cause of death was kept pending until receipt of chemical analysis and histopathology reports.

After receipt of histopathology and chemical analysis reports, the opinion as to the cause of death was issued as death due to vecuronium bromide poisoning. The case was then referred to the Corps of Detectives (COD) for further investigation.

The autopsy findings, chemical analysis report, and crime scene investigation findings indicated suicide as there

were no signs of physical violence before or during intravenous administration of the alleged muscle relaxant.

Key Words: Vecuronium bromide; Muscle relaxant; Suicide

Introduction

Pancuronium is a typical non-depolarizing curare-mimetic muscle relaxant. It acts as a competitive acetylcholine antagonist on neuromuscular junctions, displacing acetylcholine (hence competitive) from its post-synaptic nicotinic acetylcholine receptors.¹ It exerts slight vagolytic activity (i.e., diminishing activity of the vagus nerve) and no ganglioplegic (i.e., blocking ganglions) activity. Pancuronium is a very potent muscle relaxant/curare-mimetic. The ED₉₅ (i.e., a dose causing a 95% reduction in muscle activity) is only 60 mcg/kg body weight administered intravenously.² Muscle relaxation suitable for intubation sets in about 90–120 seconds after administration of the drug. Full muscle paralysis for major surgery is achieved about 2–4 minutes after application. Clinical effects (muscle activity lower than 25% of physiological) last for about 100 minutes. The time needed for full (over 90% muscle activity) recovery after single administration is about 120–180 minutes in healthy adults, but can be protracted to more hours in subjects with poor health, and when concomitantly administered with other long-acting anaesthetics (e.g., opioids, barbiturates, inhalation anaesthetics).

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Vecuronium's structure is derived from the same aminosteroid structure as pancuronium, but it is missing the methyl group on the piperidine nitrogen that is attached to the 'A' ring, making it monoquaternary, like D-tubocurarine. This means it is less potent than pancuronium as a neuromuscular blocking agent. It has the same configuration at all ten stereocentres as pancuronium, and is a single-isomer preparation. Vecuronium bromide for injection is supplied as a sterile non-pyrogenic freeze-dried buffered cake of very fine microscopic crystalline particles for intravenous injection only. Each 10 mL vial contains 10 mg vecuronium bromide, 20.75 mg citric acid anhydrous, 16.25 mg sodium phosphate dibasic anhydrous, and 97 mg mannitol (to adjust tonicity).³ The drug is given by intravenous injection or continuous infusion, under the supervision of a doctor.⁴

This case report details a suicide by vecuronium bromide by a 31 year old lady doctor. The possibility of fatality by intravenous self-administration of vecuronium bromide, and its accepted clinical superiority over other muscle relaxants are discussed in this article.

The Case: A 31 year-old female was found unconscious at her residence on the sofa in front of her bedroom, and was rushed to a private hospital nearby, where she was declared "brought dead", and the matter was reported to the police. A case was registered under sections 498(A), and 306 IPC (both relating to dowry harassment), and a magistrate's inquest was held. During investigation, the following objects were recovered from the scene:

1. Hypodermic syringe and needle
2. 4 ampoule remains of "Neovec" (vecuronium)
3. One vial of "Mezolam" (midazolam)
4. One syringe needle cover
5. One broken ampoule of atropine sulphate

These were sent to the regional forensic science laboratory at Davangere. The dead body was subjected to medicolegal postmortem examination at the medical hospital where the body had been first brought, by the forensic medicine department faculty comprising a professor, associate professor and assistant professor. The autopsy procedure was recorded partly by videography, and partly by digital photography.

Autopsy examination revealed a moderately built, fair complexioned female, with rigor mortis established all over, bluish nail beds, and bluish-pink postmortem staining over the back of the trunk. No external injuries were noted;

however, there was a dark blue discolouration over the front of right ankle on its medial part, along the course of long saphenous vein, indicating intravenous injection (**Fig 1**). There were also intravenous injection marks over the back of the left hand.

Internal examination of the body after dissection revealed the following findings. Brain was covered by a chocolate coloured subdural haematoma over the right fronto-temporal area and there was also red coloured patchy subarachnoid haemorrhage all over. Stomach revealed normal mucosa with no abnormal smell. Gall bladder was distended with bile, and spleen was congested and enlarged (425 grams). Both kidneys were multi-lobulated and congested. Uterus was enlarged measuring 13 cms in length, and contained partially separated placenta. Cervix showed partial effacement of its upper one-third part. Both the uterus and the cervix contained blood clots.

Samples of blood, gall bladder and viscera were preserved for routine chemical analysis and sent to the Forensic Science Laboratory. Pieces of brain, lungs, liver, spleen, and uterus and its appendages were sent for histopathological examination to the institutional department of pathology. Postmortem report was issued with cause of death kept pending until receipt of reports of histopathological examination and chemical analysis.

Subsequently, the histopathological report was received and revealed bilateral pulmonary oedema, and presence of products of conception in the uterus and even in the lungs.

Chemical analysis report indicated the following:

1. Vecuronium bromide (muscle relaxant) was detected in the blood sample and the hypodermic syringe by high performance thin layer chromatography (HPTLC) and liquid chromatography with tandem mass spectrometry (LC-MS-MS). The concentration of vecuronium bromide was 0.022 mg/l of blood. There was a note that following administration of vecuronium bromide (0.08-0.1 mg/kg), neuromuscular blockade begins within 1 minute and peaks in 3-5 minutes. 60-90% of the drug is bound to plasma protein. Therefore the quantum of vecuronium bromide reported refers to unbound form.
2. UV Spectrophotometric and HPTLC methods reported the presence of a) midazolam in the vial recovered at the scene, and b) atropine in the broken ampoule, also recovered at the scene.

3. Vecuronium bromide was detected in the 4 broken ampoules of "Neovec" recovered from the scene.

On the basis of all of the above, the final cause of death was furnished as follows: Death was due to respiratory failure as a result of injection of vecuronium bromide.



Fig 1: Bluish Discolouration over Medial Side of Right Ankle

Discussion

Vecuronium bromide or more commonly, pancuronium bromide is used as one component of a lethal injection in administration of death penalty in some parts of United States.⁵ Vecuronium bromide is best given by intravenous administration. If this is not possible, intramuscular administration seems to be an acceptable alternative. Theoretically speaking, here the risk exists that release of the substance from the muscle is irregular and hence not so reliable. Experience with intramuscular injection as a euthanasic, however, suggests that an adequate effect can be obtained within a limited time, provided that a high dose is injected in the proper way of route of administration. Risk exists that release of the substance from the muscle is irregular and hence not so reliable.⁶ The effects of vecuronium and pancuronium can be at least partially reversed by anticholinesterasics such as neostigmine, pyridostigmine, and edrophonium.⁷

Experience with intramuscular injection of vecuronium as a euthanasic, however, suggests that an adequate effect can be obtained within a limited time, provided that a high dose is injected in the proper way. Oral or rectal administration does not enter into consideration because, due to their quaternary structure, muscle relaxants are poorly absorbed by other routes of administration. Hence administration of vecuronium or pancuronium bromide warrants knowledge as to at least intramuscular administration, if not intravenous route. Intravenous administration of such drugs is possible by paramedical/medical

professionals, but is not expected of the common lay public. If at all vecuronium bromide is detected in deceased individuals other than paramedical/medical professionals, then it raises suspicion of foul play. Self administration of drugs such as vecuronium is possible in the case of paramedical or medical professionals having high degree of anatomical knowledge and skill of intravenous injection. They are expected to be well aware of selecting the preferred part of the body, vein, site of injection and its accessibility, etc.

Unlike other nondepolarizing skeletal muscle relaxants, vecuronium has no clinically significant effects on haemodynamic parameters. It does not counteract haemodynamic changes or known side effects produced by or associated with anaesthetic agents, other drugs, or various other factors known to alter haemodynamics.³ This property of vecuronium bromide may be the reason for preferring it over other newer muscle relaxants to end one's life.

In this case, the deceased was an anaesthetist by profession having the requisite knowledge and skills of intravenous administration, awareness about the accessible site of injection in the region of the ankle, etc. Absence of evidence of struggle in the form of mechanical wounds also leads one to the conclusion that it was a case of self-administration of vecuronium by the deceased. The detection of products of conception in the uterus are signs of recent abortion in the given case, and could be a motive for suicide. The fact that some products of conception were even observed in the lungs indicates embolisation of products of conception and should have warranted hospitalisation of the deceased, but this does not appear to have been done on perusal of documents that were submitted to us.

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