



# NECK HEMATOMA AFTER CENTRAL VENOUS CATHETERIZATION AND AWAKE INTUBATION AS RESCUE AIRWAY MANAGEMENT TECHNIQUE: A CASE REPORT

Matea Mrčelić, Renata Curić Radivojević and Marina Kljaković-Gašpić Batinjan

Department of Anesthesiology, Resuscitation, Intensive Medicine and Pain Therapy, Zagreb University Hospital Center, Zagreb, Croatia

**SUMMARY** – Central venous catheterization (CVC) of the internal jugular vein is an invasive procedure commonly performed in anesthesiology practice. Usually it is an uneventful procedure but complications such as bleeding, infection, and potential damage to the surrounding structures can occur. One of the complications is neck hematoma, which can distort airway anatomy and cause upper airway obstruction. We present a patient who underwent endovascular mitral valve repairment procedure under general anesthesia. Accidental puncture of carotid artery occurred while attempting to place the central line. Later, during awakening in the coronary intensive care unit, the patient developed neck hematoma. The diagnosis was confirmed with multi-slice computed tomography (MSCT) and MSCT angiography showed active arterial blood extravasation. Despite it, the patient was extubated. Awake tracheal intubation (ATI) with video laryngoscopy was the technique of choice for reintubation because of the neck swelling and compression onto laryngeal structures. In this case, rushed extubation put the patient at risk. Video laryngoscopy ATI with appropriate preparation and titrated sedation can enable quick and safe rescue airway management in patients with rapidly developing neck hematoma, along with definitive evacuation and treatment.

*Key words: Neck hematoma; Advanced airway management; Central venous catheterization*

## Introduction

Neck hematomas originate from capillary leakage and venous or arterial bleeding, usually caused by trauma, surgery, or tumors<sup>1-4</sup>. Although central venous catheterization (CVC) of internal jugular vein is a commonly performed and usually uneventful procedure in day-to-day clinical practice, it could be the

cause of neck hematoma development. Once suspected, it presents an anticipated difficult airway due to distorted airway anatomy and an impending upper airway obstruction. Awake tracheal intubation (ATI) must be considered in the presence of predictors of difficult airway management<sup>5</sup>. It is commonly performed with flexible bronchoscopes but the role of alternative airway devices such as video laryngoscopes and optical stylets cannot be diminished<sup>6</sup>.

In this paper, we present a patient with cervical hematoma developed after iatrogenic injury to the carotid artery due to unsuccessful CVC and the application of advanced airway management techniques out of the operating room.

Correspondence to: *Renata Curić Radivojević, MD, PhD*, Department of Anesthesiology, Resuscitation, Intensive Medicine and Pain Therapy, Zagreb University Hospital Center, Kišpatićeva 12, HR-10000 Zagreb, Croatia  
E-mail: r.curicradivojevic@gmail.com

## Case Report

An 81-year-old male patient was admitted to the cardiology ward for a scheduled endovascular mitral valve repairment procedure (MitraClip, Abbott Vascular, Santa Clara, California, USA). The patient had a history of hypertension, chronic renal failure, combined valvular and ischemic cardiomyopathy with left ventricular ejection fraction (LVEF) 45%-50%, severe mitral valve insufficiency with prolapse of posterior cusps, permanent atrial fibrillation for which he had atrioventricular (AV) node ablation done in 2018, while in 2016 he had percutaneous coronary intervention (PCI) with one drug-eluting stent (DES) placed in left anterior descending (LAD); in the same year, because of bradycardia, he underwent successful implantation of cardiac resynchronization therapy with defibrillator (CRT-D). At admission, he was feeling no symptoms and showed no signs of acute disease, and days prior to the procedure went by uneventfully. Laboratory tests and chest x-ray were all within the normal limits, and he was cleared for the procedure by the anesthetist. The patient arrived at CathLab at 8.30 AM. Upon arrival, extended monitoring was set up including HR, ECG, SpO<sub>2</sub>, etCO<sub>2</sub>, cannulated radial artery for IBP, BIS and 2 peripheral vein accesses. Patient was preoxygenated and anesthesia was induced with intravenous administration of midazolam 3 mg, sufentanil 15 mcg, etomidate 16 mg and rocuronium 60 mg. The patient was intubated with size 8.5 cuffed endotracheal tube using direct laryngoscopy. After induction, the patient was prepared for central line placement. Right internal jugular vein was the location of choice. At the first attempt, using landmark guidance, arterial blood was withdrawn. The needle was immediately pulled out and digital compression was applied for 5 minutes. There were no signs of edema, hematoma, or bleeding. Another two attempts followed, using a posterior and central approach, but in both cases, there was no aspiration of blood. It was then that the ultrasound machine was brought into CathLab and after careful inspection, it was clear that the internal jugular vein had collapsed. It was then decided to try and place the central line in the femoral vein, which was successfully done by a cardiologist. The procedure started at 9.10 AM, lasted for 3 hours, anesthesia was maintained with propofol infusion, and the patient was hemodynamically stable throughout that time. During

the procedure, 10000 IU of heparin were administered to the patient as *per* protocol for invasive endoscopy procedures. Before leaving CathLab, the patient's neck was once again inspected for signs of hematoma, and none was found. While still sedated and intubated, the patient was transferred to the coronary unit for observation and recovery after the procedure. Around 2 PM, swelling on the right side of the patient's neck was noticed and bedside ultrasound examination suggested it was hematoma, which was then further evaluated with emergency computer tomography (CT) scans. The patient was extubated shortly after undergoing CT scanning before the radiologist reviewed the scans. Emergency CT scans confirmed the diagnosis of right sided cervical hematoma that caudally reached mediastinum and was pushing all laryngeal structures contralaterally (Figs. 1 and 2). CT angiography showed active extravasation of blood (Fig. 3). A vascular surgeon was consulted and indicated emergency surgery



*Fig. 1. Neck CT scan showing large hematoma shifting all laryngeal structures contralaterally.*

to repair the artery and stop active bleeding. Also, since extubated, the patient's airway was in danger of becoming quickly compromised. At that time, an experienced anesthesiologist was called to manage the airway. Upon arrival of the anesthetist, the patient was completely conscious, receiving oxygen *via* face mask with reservoir bag at flow rate of 12 L/min, SpO<sub>2</sub> was 98%, he was normotensive, had normal heart rate and rhythm, his voice was unchanged, the neck was wide

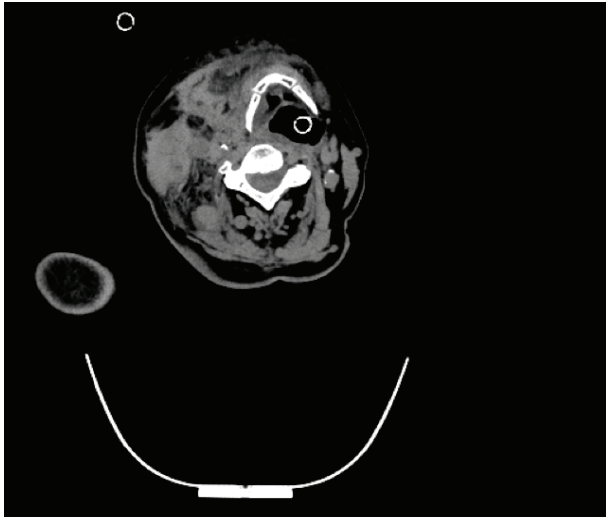


Fig. 2. Neck CT scan showing large hematoma pushing hyoid bone away from midline.

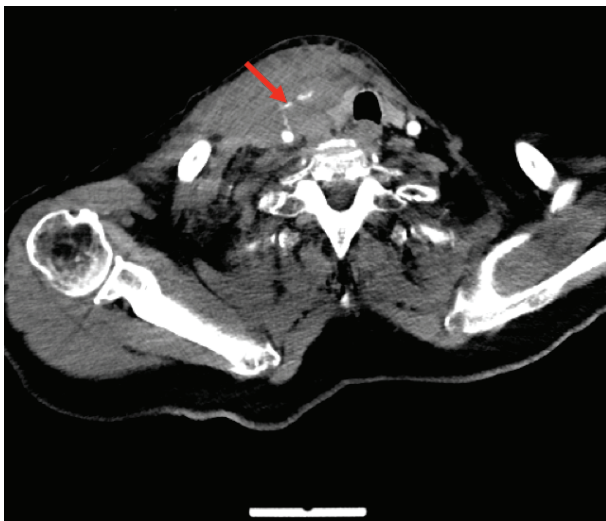


Fig. 3. Neck CT angiography showing large hematoma with active extravasation of blood (red arrow).

and laryngeal structures were shifted to the left. It was decided to proceed with awake intubation with video laryngoscopy. Airway topicalization was established with lidocaine. He then received 5 mcg of sufentanil, 1 mg of midazolam and fractionated in total 200 mg of S(+)-ketamine. After administration of drugs, he was still responding to verbal stimuli and was able to follow simple orders. The patient actively opened his mouth when asked to do so, and McGrath™ MAC (Medtronic, Minneapolis, Minnesota, USA)

video laryngoscope with plastic, single use blade number 4 was gently inserted inside his mouth. Laryngoscope was carefully advanced until vocal cords were visible and size 6 cuffed endotracheal tube with spiral reinforcement was placed upon the first try. Position of the tube was confirmed with lung auscultation and capnography. Afterwards, 100 mg of propofol and 100 mg of rocuronium were administered. Once the anesthesia was induced and the patient was relaxed, there was a noticeable air leak. The original tube was carefully exchanged *via* tube exchange catheter with video laryngoscope guidance and replaced with a bigger, size 7 cuffed tube. The placement of the tube was again confirmed by auscultation and capnography. The tube was then secured, and the patient was transported to the operating room for an emergency procedure. The surgeons were able to find the lesion on the common carotid artery, they placed the sutures and drain. After the surgery, the patient was transferred to the intensive care unit (ICU), where he was successfully extubated after a total of 11 hours of mechanical ventilation. Low molecular weight heparin in therapeutic doses was introduced on the first postoperative day while monitoring anti-Xa concentration. Warfarin conversion started two days later. Drain was removed on the second postoperative day, and on the fourth postoperative day the patient was transferred to the ward. Recovery was complete and successful.

## Discussion

Arterial puncture occurs in 4.2%-9.3% of central line placements and is often easily recognized secondary to pulsatile flow<sup>7</sup>. It occurs most commonly in femoral catheter placement and least commonly in subclavian placement<sup>7</sup>. Hematoma formation has been reported in up to 4.7% of all catheter placements<sup>7</sup>. Typically, most patients present within 24 hours of their original procedure<sup>7</sup>. Multiple studies have demonstrated the benefit of using ultrasound to reduce vascular complications, and ultrasound is nowadays considered gold standard in CVC<sup>8-10</sup>. In our case, the patient was receiving large doses of diuretics two days prior to the procedure in order to facilitate performance, and the procedure took place in CathLab where it is not possible to place the patient in the Trendelenburg position. This together led to jugular vein collapse which then, along with the use of anatomic landmarks (*vs.* ultra-

sound guidance), led to multiple unsuccessful attempts during central line placement.

Along with multiple attempts to central line placement, another factor directly contributing to hematoma development is heparin administration and non-reversal with protamine. Interventional cardiology procedures require full anticoagulation to prevent thrombus formation on catheters and devices with potential development of embolic complications<sup>11</sup>. For MitraClip procedure, an initial bolus of heparin is given after transseptal puncture<sup>12</sup>. Although in some centers, the action of heparin is reversed using protamine at the end of the procedure, this is not universally recommended<sup>12</sup>. In our hospital, protamine reversal is not routinely used but is rather reserved for patients with bleeding complications. Since the patient had no signs of bleeding at the end of the procedure, interventional cardiologist decided there was no need for protamine administration.

Neck hematoma can progress to airway obstruction with fatal outcome<sup>13</sup>. Attending physician in the coronary ICU, where the patient was transferred after MitraClip procedure, was unaware of the neck hematoma potential influence on airway patency. Our patient had a secured airway at the time of diagnosis and this unawareness created unnecessary risk. In the majority of cases, patients with neck hematoma of any cause are being treated in narrowly specialized surgical departments for head and neck surgery, so handling patients with neck hematoma is not common on other wards and by all medical staff. The Difficult Airway Society (DAS) in collaboration with ENT-UK have recently published guidelines for hematoma management after thyroid surgery<sup>13</sup>. While these guidelines are specific for thyroid surgery, the principles may apply to other forms of neck procedures. These are only the first guidelines in this area, and they aim to support early recognition of hematoma, oxygenation and clinical airway evaluation, hematoma evacuation and airway management in patients with neck hematoma, through individual and organizational preparedness<sup>13</sup>.

Awake tracheal intubation should be considered every time difficult intubation is anticipated. This procedure involves placing a tracheal tube in an awake, spontaneously breathing patient, most commonly with flexible bronchoscopy or video laryngoscopy<sup>5,14</sup>. This allows the airway to be secured before induction of general anesthesia, avoiding the potential risks and

consequences of difficult airway management in an anesthetized patient<sup>15</sup>. ATI was executed following the key principles of DAS guidelines<sup>5</sup>. The key components of ATI are sedation, topicalization, oxygenation and performance – sTOP acronym; the ‘s’ is in lower case to emphasize the optional nature of sedation<sup>5</sup>. Topical anesthesia with or without additional sedation is preferred but it must be taken into consideration that it takes time to be adequate, and in case of an emergency, time is often limited. That is why in our case, to provide as comfortable an experience as possible, we additionally administered small doses of intravenous opioid analgesic and ketamine. The administration of supplemental oxygen during ATI is recommended, and if available, high-flow nasal oxygen should be the technique of choice<sup>5</sup>. As it was not temporarily available in our case, we continued with oxygen therapy the patient was already receiving (face mask with reservoir bag at flow rate of 12 L/min) and no desaturation occurred during the procedure. Recently published DAS society guidelines for ATI present the key principles and suggested strategies for preparation, performance, consent and training to improve clinical practice, as stated by the authors, but clinical judgment according to situation, available equipment and staff training must also be taken into consideration.

## Conclusion

This case showed us that not all physicians are aware of neck hematoma effects on airway patency. Safe transfer of patient care between healthcare teams within different areas of the hospital is a key consideration. We should work on training all medical staff with neck hematoma implications on airway patency. Prompt recognition of developing neck hematoma is crucial, and so is evacuation and early airway management. Video laryngoscopy ATI with appropriate preparation and cautious sedation can enable quick and safe rescue airway management in patients with rapidly developing neck hematoma of non-surgical cause, before or in parallel to definitive evacuation and treatment.

## References

1. Peroulis M, Lianos GD, Nousias V, Anastasiadi Z, Lianou A, Katsios C, Matsagkas M. An Uncommon, Life-Threatening, Traumatic Hematoma in the Neck Area. *Case Rep Emerg Med.* 2014, Article ID 603742, 3 pages, 2014. doi: 10.1155/2014/603742

2. Shah-Becker S, Greenleaf EK, Boltz MM, Hollenbeak CS, Goyal N. Neck hematoma after major head and neck surgery: risk factors, costs, and resource utilization. *Head Neck*. 2018;40:1219-27. doi: 10.1002/hed.25102
3. Alfraidi D, Helmi H, Alamodi Alghamdi M, Bokhari A, Alsaif A. Rare cause of acute neck hematoma. *Clin Case Rep*. 2019;7:1378-81. doi: 10.1002/ccr3.2248
4. Tessler I, Adi M, Diment J, Lahav Y, Halperin D, Cohen O. Spontaneous neck hematoma secondary to parathyroid adenoma: a case series. *Eur Arch Otorhinolaryngol*. 2020 Sep;277(9):2551-8. doi: 10.1007/s00405-020-05959-z
5. Ahmad I, El-Boghdadly K, Bhagrath R, Hodzovic I, McNarry AF, Mir F, O'Sullivan EP, Patel A, Stacey M, Vaughan D. Difficult Airway Society guidelines for awake tracheal intubation (ATI) in adults. *Anaesthesia*. 2020;75:509-28. doi: 10.1111/anae.14904
6. Desai N, Ratnayake G, Onwochei DN, El-Boghdadly K, Ahmad I. Airway devices for awake tracheal intubation in adults: a systematic review and network meta-analysis. *Br J Anaesth*. 2021 Oct;127(4):636-47. doi: 10.1016/j.bja.2021.05.025. Epub 2021 Jul 22. PMID: 34303493.
7. Kornbau C, Lee KC, Hughes GD, Firstenberg MS. Central line complications. *Int J Crit Illn Inj Sci*. 2015;5(3):170-8. doi: 10.4103/2229-5151.164940
8. Bhatta ST, Culp WC. Evaluation and management of central venous access complications. *Tech Vasc Interv Radiol*. 2011;14:217-24. doi: 10.1053/j.tvir.2011.05.003
9. Leung J, Duffy M, Finckh A. Real-time ultrasonographically-guided internal jugular vein catheterization in the emergency department increases success rates and reduces complications: a randomized, prospective study. *Ann Emerg Med*. 2006;48:540-7. doi: 10.1016/j.annemergmed.2006.01.011
10. Bowdle A. Vascular complications of central venous catheter placement: evidence-based methods for prevention and treatment. *J Cardiothorac Vasc Anesth*. 2014;28:358-68. doi: 10.1053/j.jvca.2013.02.027
11. Saia F, Biagini E, Berardini A, Chiarabelli M, Bertolino E, Compagnone M, Rapezzi C. Antithrombotic management during percutaneous mitral valve repair with the Mitraclip system in a patient with heparin-induced thrombocytopenia. *TH Open*. 2018 Nov 10;2(4):e387-e390. doi: 10.1055/s-0038-1675586
12. Boekstegers P, Hausleiter J, Baldus S, von Bardeleben RS, Beucher H, Butter C, Franzen O, Hoffmann R, Ince H, Kuck KH, Rudolph V, Schäfer U, Schillinger W, Wunderlich N; Germany Society of Cardiology Working Group on Interventional Cardiology Focus Group on Interventional Mitral Valve Therapy. Percutaneous interventional mitral regurgitation treatment using the Mitra-Clip system. *Clin Res Cardiol*. 2014 Feb;103(2):85-96. doi: 10.1007/s00392-013-0614-x
13. Iliff HA, El-Boghdadly K, Ahmad I, Davis J, Harris A, Khan S, *et al.* Management of haematoma after thyroid surgery: systematic review and multidisciplinary consensus guidelines from the Difficult Airway Society, the British Association of Endocrine and Thyroid Surgeons and the British Association of Otorhinolaryngology, Head and Neck Surgery. *Anaesthesia*. 2022;77:82-95. doi: 10.1111/anae.15585
14. Alhomary M, Ramadan E, Curran E, Walsh SR. Videolaryngoscopy *vs.* fiberoptic bronchoscopy for awake tracheal intubation: a systematic review and meta-analysis. *Anaesthesia*. 2018 Sep;73(9):1151-61. doi: 10.1111/anae.14299
15. Russotto V, Myatra SN, Laffey JG, *et al.* Intubation practices and adverse peri-intubation events in critically ill patients from 29 countries. *JAMA*. 2021;325(12):1164-72. doi: 10.1001/jama.2021.1727

#### Sažetak

### HEMATOM NA VRATU NAKON KATETERIZACIJE CENTRALNE VENE I INTUBACIJA NA BUDNO KAO ZBRINJAVANJE DIŠNOGA PUTA: PRIKAZ SLUČAJA

*M. Mrčelić, R. Curić Radivojević i M. Kljaković-Gašpić Batinjan*

Postavljanje centralnog venskog katetera (CVK) u unutarnju jugularnu venu je invazivan postupak koji se često izvodi u anesteziološkoj praksi. Obično je bez komplikacija, no mogu se dogoditi komplikacije poput krvarenja, infekcije i potencijalnog oštećenja okolnih struktura. Jedna od komplikacija je i hematoma vrata koji može narušiti anatomiju dišnih putova i uzrokovati opstrukciju gornjih dišnih putova. Prikazani bolesnik podvrgnut je endovaskularnom popravku mitralnog zaliska u općoj anesteziji. Tijekom pokušaja postavljanja CVK-a došlo je do slučajne punkcije karotidne arterije. Kasnije, tijekom buđenja u koronarnoj jedinici, bolesnik je razvio hematoma na vratu. Dijagnoza je potvrđena MSCT-om, a MSCT angiografija pokazala je aktivnu ekstrasvazaciju krvi. Unatoč tome, bolesnik je ekstubiran. Intubacija na budno (ATI) s video laringoskopom bila je tehnika izbora za reintubaciju zbog otoka vrata i kompresije na dišni put. U prikazanom slučaju ishitrena ekstubacija je bolesnika dovela u opasnost. ATI s video laringoskopom uz odgovarajuću pripremu i titriranu sedaciju može omogućiti brzo i sigurno zbrinjavanje dišnog puta u bolesnika s brzo razvijajućim hematomom vrata uz evakuaciju i zbrinjavanje uzroka hematoma.

**Ključne riječi:** *Hematoma vrata; Napredno zbrinjavanje dišnog puta; Centralni venski kateter*