DOI: 10.7860/JCDR/2026/85561.23359

Case Series

Anaesthesia Section

Retained and Knotted Guidewires during Central Venous Catheterisation: A Case Series on Anaesthetic Management, Endovascular Retrieval, and Preventive Strategies

KRITI BHANDARI[1], BHARAT CHOUDHARY[2], ABHINAV SINGH[3], DEVARAM[4], K KAVYA[5]

ABSTRACT

Retained or knotted guidewires during Central Venous Catheterisation (CVC) are rare but entirely preventable complications that may result in serious cardiovascular and vascular consequences, including arrhythmias, embolisation and vascular injury. Despite widespread adoption of ultrasound-guided techniques, guidewire-related events continue to occur, particularly in high-pressure clinical environments. Present case series is of three patients who developed guidewire-related complications following right subclavian vein cannulation. Two patients experienced complete guidewire retention with distal migration extending from the superior vena cava to the ipsilateral iliac vein, while one patient developed intravascular knotting at the subclavian–brachiocephalic junction following resistance during insertion. All patients were haemodynamically stable at presentation, with one reporting intermittent palpitations. Endovascular retrieval was performed in a hybrid operating theatre using a femoral venous approach with a 7 French sheath and a 5 French vascular snare under fluoroscopic guidance. All procedures were conducted under Monitored Anaesthesia Care (MAC) using midazolam, fentanyl and dexmedetomidine, which provided cooperative sedation, preserved spontaneous ventilation, and haemodynamic stability throughout the intervention. Retrieval was successful in all three cases without vascular injury, arrhythmias, or procedure-related complications. Postprocedure imaging confirmed complete removal of the guidewire without residual fragments. This case series is unique in emphasising the anaesthetic considerations during endovascular retrieval of retained and knotted guidewires, an aspect that is infrequently described in existing literature. It underscores the importance of early recognition, multidisciplinary coordination, and vigilant anaesthetic management, while reinforcing strict adherence to guidewire handling techniques to prevent these potentially catastrophic yet avoidable complications.

Keywords: Anaesthesia, Dexmedetomidine, Fluoroscopy, Patient safety

INTRODUCTION

The CVC is a routinely performed life-saving procedure. Since Seldinger SI introduced the wire-guided technique in 1953 [1], the procedure has been widely adopted. Although generally safe, it carries mechanical risks such as arterial puncture, pneumothorax, and catheter malposition [2,3]. Guidewire-related complication-including retention, coiling, knotting, and entrapment- are particularly concerning as they represent entirely preventable "never events" that may result in arrhythmias, thrombosis, vascular injury, migration, or infection and may progress to vessel perforation or venous obstruction [4-6]. Recent reports continue to document retained guidewires despite advances in ultrasound guidance [7]. Pokharel K et al., identified an increasing trend, attributing such events to high workload, inadequate supervision, and inconsistent training [8]. The Joint Commission has also reported fatal sentinel events related to retained guidewires, highlighting their clinical significance [9]. While endovascular retrieval techniques are well described, anaesthetic considerations receive less emphasis. Retrieval may provoke haemodynamic instability, arrhythmias, pain, and anxiety [10]. Dexmedetomidine provides cooperative sedation with minimal respiratory depression and stable haemodynamics, making it suitable for MAC [11,12]. This case series describes three patients with retained or knotted guidewires following subclavian CVC insertion and highlights anaesthetic strategies facilitating safe retrieval.

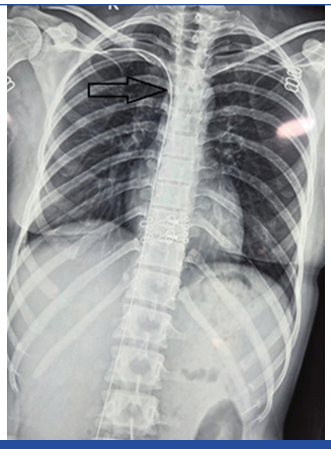
CASE SERIES

Case 1

A 29-year-old female with B-cell acute lymphoblastic leukaemia diagnosed one month earlier was admitted for chemotherapy administration. She had no other co-morbidities and a normal coagulation profile (international normalised ratio and platelet count within normal limits). Right subclavian venous catheterisation was performed by a third-year postgraduate under expert supervision using a 7 Fr, 16 cm triple-lumen central venous catheter with a 0.035-inch, 45 cm long nitinol J-tip guidewire (ALSPL Central Venous Catheter Kit). A chest radiograph obtained the following day revealed an inadvertently retained guidewire extending from the right subclavian vein through the right atrium and inferior vena cava into the right iliac vein [Table/Fig-1]. The patient complained of intermittent palpitations but remained haemodynamically stable with no clinical signs of cardiovascular compromise.

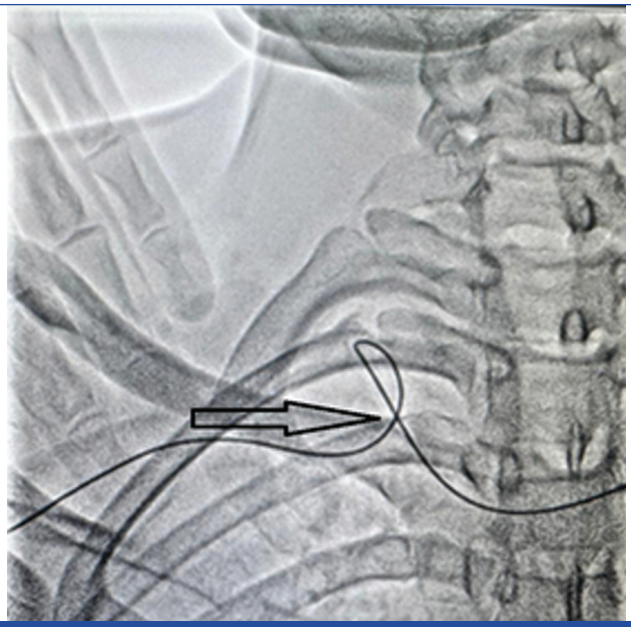
Case 2

A 21-year-old man presenting with fever of unknown origin and hypotension (blood pressure 90/54 mmHg, heart rate 110/min), with no co-morbidities and a normal coagulation profile. Right subclavian venous access was secured by a second-year postgraduate using a 7 Fr, 16-cm triple-lumen central venous catheter with a 0.035-inch, 45-cm long nitinol J-tip guidewire (ALSPL Central Venous Catheter Kit) for vasopressor and fluid administration. Resistance



[Table/Fig-1]: Chest radiograph showing a retained guidewire extending from the right subclavian venous entry site into the right atrium, inferior vena cava, and down to the right iliac vein (arrow). The extensive migration pattern suggests loss of proximal wire control during insertion, allowing inadvertent advancement of the entire guidewire.

was encountered during guidewire insertion and the wire could not be withdrawn. Fluoroscopy revealed a knotted guidewire at the subclavian–brachiocephalic junction, with the proximal end protruding externally [Table/Fig-2].

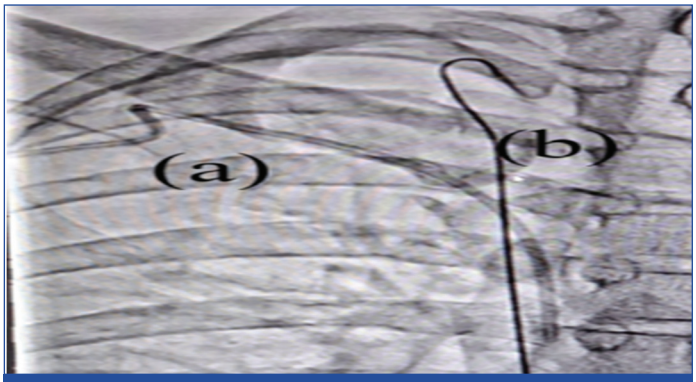


[Table/Fig-2]: Fluoroscopic image showing an intravascularly knotted guidewire (arrow) at the right subclavian–brachiocephalic junction. The knot likely formed due to inadvertent forceful advancement of the guidewire against resistance during cannulation, resulting in looping and entrapment within the vessel.

Case 3

A 28-year-old man with a two-year history of depression and intravenous drug abuse who presented following intentional ingestion of clonazepam (2 mg tablets; three to four tablets together). Peripheral venous access was difficult due to sclerosed veins, necessitating right subclavian venous catheterisation. The procedure was performed by a supervised junior resident using a 7 Fr, 16-cm triple-lumen catheter with a 0.035-inch, 50-cm long nitinol J-tip guidewire (Romsons Central Venous Catheter Kit). A same-day chest radiograph revealed a retained guidewire with the J-tip in the superior vena cava and distal migration into the ipsilateral iliac vein. The patient remained asymptomatic and haemodynamically stable [Table/Fig-3].

All patients were shifted to the hybrid operating theatre. Standard monitoring was instituted, a wide-bore intravenous line was secured, and Ringer's lactate (500 mL) was initiated. Oxygen was administered via face mask at 6 L/min. Procedures were performed under MAC with preserved spontaneous ventilation using intravenous midazolam (1 mg), fentanyl (50 µg), and dexmedetomidine (0.5



[Table/Fig-3]: Fluoroscopic image demonstrating a retained guidewire (b) lying parallel to the right subclavian central venous catheter (a). The configuration suggests inadvertent insertion from the straight (non–J-tip) end or loss of proximal wire control, allowing unintentional intravascular advancement and retention.

µg/kg loading over 10 minutes followed by 0.2-0.5 µg/kg/h). Airway equipment, emergency drugs and a crash cart were kept immediately available.

The right femoral vein was cannulated as it provides a direct route to the inferior vena cava, facilitates snaring of the free guidewire end and offers a compressible access site with lower thoracic risk [12]. A 7 Fr sheath was introduced under ultrasound guidance and a 5 Fr vascular snare was advanced under fluoroscopy [Table/Fig-4].

[Table/Fig-4]: Fluoroscopic image demonstrating snare retrieval of the retained guidewire. The vascular snare (arrow) introduced through the femoral venous sheath is seen encircling the distal end of the guidewire, allowing controlled capture and extraction. This confirms correct engagement of the wire during endovascular retrieval.

In the first and third patients, the guidewires were retrieved intact. In the second patient, controlled traction allowed knot disengagement without vascular injury, followed by complete retrieval. Post-procedure fluoroscopy and ultrasound confirmed complete guidewire removal and venous patency in all cases. All three patients remained haemodynamically stable, with details summarised in [Table/Fig-5]. The first patient continued chemotherapy, while the remaining two recovered uneventfully and were discharged after observation.

DISCUSSION

Guidewire retention is an uncommon but entirely preventable complication of CVC. In the present series, guidewire loss occurred despite routine use of the Seldinger technique and was attributable to momentary loss of proximal wire control, forceful advancement against resistance, or technical lapse during catheter insertion. All cases were recognised early, allowing prompt intervention before the development of major cardiovascular or vascular sequelae, reinforcing the fact that loss of continuous guidewire control remains the most frequent mechanism [3,5,6].

Several published reports have highlighted similar mechanisms. Schummer W et al., and Polderman KH and Girbes ARJ identified procedural haste, distraction, and inadequate supervision as key contributors to guidewire-related mishaps [3,5]. In the Indian

Case	Patient	Complication	Location / Migration	Possible mechanism	Retrieval	Fluoroscopy duration (minutes)	Time to retrieval minutes)	Outcome
1	29F, B-ALL	Retained guidewire	Right subclavian → RA → IVC → right iliac vein	Loss of proximal guidewire control during catheter advancement	Femoral access, 7 Fr sheath, 5 Fr snare under C-arm guidance	8	5	Haemodynamically stable; chemotherapy continued
2	21M	Knotted guidewire	Right subclavian–brachiocephalic junction	Guidewire advancement against resistance, resulting in intravascular knotting	Controlled manipulation with gradual traction under C-arm guidance	6	3	Haemodynamically stable; discharged
3	28M	Retained guidewire	Right subclavian → SVC → RA → IVC → ipsilateral iliac vein	Loss of proximal guidewire control with unintended distal migration	Femoral access, 7 Fr sheath, 5 Fr snare under C-arm guidance	10	6	Haemodynamically stable; discharged

[Table/Fig-5]: Clinical summary of the three cases.
B-ALL: B-cell acute lymphoblastic leukaemia; RA: Right atrium; IVC: Inferior vena cava; SVC: Superior vena cava

Domain	Preventive measure
Wire handling	Maintain continuous manual control of the proximal end of the guidewire until its complete removal [3,5,6]
Insertion technique	Do not advance the guidewire against resistance; stop and reassess using ultrasound or fluoroscopy if required [5,8]
Confirmation of venous access	Confirm venous entry by ultrasound visualisation and free aspiration of venous blood before advancing the guidewire [2,3]
Checklist usage	Implement a central venous catheter checklist with verbal confirmation of "wire in–wire out" [7,13]
Supervision	Ensure direct senior supervision for trainee-performed central venous access, especially in emergency settings [5,6]
Postprocedure verification	Mandatory review of postprocedure chest radiograph with specific documentation of guidewire absence [8,13]
Training	Incorporate structured training and periodic competency assessment for operators performing CVC insertion [7,13]
Human factors	Minimise procedural distractions, interruptions, and fatigue-related errors [7,8]
System safeguards	Introduce an institutional guidewire count protocol similar to operating room instrument counts [13]

[Table/Fig-6]: Preventive strategies for retained or knotted guidewire during Central Venous Catheterisation (CVC) [3,5-8,13].

healthcare setting, a substantial proportion of CVCs- particularly in teaching hospitals- are inserted by trainees under variable supervision as was observed in present series as well. While essential for skill acquisition, this environment increases susceptibility to technique variability and workflow interruptions, emphasising structured supervision and adherence to standardised protocols [5,6].

Retained guidewires may remain clinically silent or migrate unpredictably within the vascular system. Safari H et al., described migration into major central veins, cardiac chambers, and even intracranial spaces, including delayed scalp extrusion [7]. Other reports have documented serious complications such as cardiac tamponade, infarction, and vascular perforation, underscoring the need for early detection and timely removal of intravascular foreign bodies [5,7]. In present series, all guidewires were successfully retrieved using a femoral venous approach with a 7 Fr sheath and 5 Fr snare under fluoroscopic guidance, consistent with published recommen-dations for endovascular retrieval [10]. Knot disengagement in one patient required careful manipulation and controlled traction, highlighting the importance of coordinated multidisciplinary expertise involving anaesthesiology, cardiothoracic, and vascular teams. From an anaesthetic perspective, maintaining spontaneous ventil-ation and haemodynamic stability is crucial during endovascular retrieval. Dexmedetomidine-based MAC provided cooperative sedation with minimal respiratory depression and stable haemodynamics, making it well suited for short fluoroscopy-guided interventions [11,12].

Prevention remains the cornerstone of management [Table/Fig-6] [3,5-8,13]. Beyond technical measures such as continuous guidewire control and avoidance of forceful advancement, human factors- including fatigue, task interruptions, and inconsistent supervision- play a major role [13]. System-level safeguards, including structured training, standardised checklists with "wire-in-wire-out" confirm as was in present series as wellation, and routine postprocedure imaging review, significantly reduce such events in teaching institutions [10,13]. Together, these highlight that effective prevention requires both technical discipline and a strong institutional safety culture.

CONCLUSION(S)

Fluoroscopic endovascular retrieval through a femoral venous approach is a safe and effective method for managing retained or knotted guidewires following CVC. Early recognition allows timely intervention and prevents progression to serious cardiovascular or vascular sequelae. Successful retrieval requires close multidisciplinary coordination between anaesthesiology, cardiothoracic, and vascular teams. MAC with dexmedetomidine provides cooperative sedation with preserved spontaneous ventilation and haemodynamic stability, making it well suited for these procedures. As most guidewire-related complications arise from preventable technical and human-factor errors, strict adherence to guidewire-handling protocols, structured supervision, and institutional safety measures is essential.

REFERENCES

[1] Seldinger SI. Catheter replacement of the needle in percutaneous arteriography: A new technique. Acta Radiol. 1953;39:368-76.
[2] McGee DC, Gould MK. Preventing complications of central venous catheterisation. N Engl J Med. 2003;348:1123-33.
[3] Schummer W, Schummer C, Gaser E, Bartunek R. Loss of the guide wire: Mishap or blunder? Br J Anaesth. 2002;88:144-46.
[4] Kornbau C, Lee KC, Hughes GD, Firstenberg MS. Central line complications. Int J Crit Illn Inj Sci. 2015;5:170-78.
[5] Polderman KH, Girbes ARJ. Central venous catheter use. Part 1: Mechanical complications. Intensive Care Med. 2002;28:1-17.
[6] Ghatak T, Azim A, Baronia AK, Ghatak A. Accidental guide-wire loss during central venous cannulation: A report of two cases. Indian J Crit Care Med. 2013;17:53-54.
[7] Safari H, Rasras S, Bakhtiari M. Retention of guidewire during central venous catheter insertion: Case report and review of the literature. SAGE Open Med Case Rep. 2025;13:01-07.
[8] Pokharel K, Biswas BK, Tripathi M, Subedi A. Missed central venous catheter guide wires: A systematic review of published case reports. Crit Care Med. 2015;43:1745-56.
[9] The Joint Commission. Sentinel Event Alert, Issue 51: Preventing unintended retained foreign objects. Oakbrook Terrace (IL): The Joint Commission; 2013.
[10] Guilbert MC, Elkouri S, Bracco D, Corriveau MM, Beaudoin N, Dubois MJ, et al. Arterial trauma during central venous catheter insertion: Case series, review, and proposed algorithm. J Vasc Surg. 2008;48:918-25.

[11] Ebert TJ, Hall JE, Barney JA, Uhrich TD, Colinco MD. The effects of increasing plasma concentrations of dexmedetomidine in humans. Anesthesiology. 2000;93:382-94.
[12] Jalowiecki P, Rudner R, Gonciarz M, Kawecki P, Petelenz M, Dziurdzik P. Sole use of dexmedetomidine for sedation during outpatient colonoscopy. Anesth Analg. 2005;101:470-73.
[13] Peh WM, Loh WJ, Phua GC, Loo CM. Eliminating guidewire retention during ultrasound guided central venous catheter insertion via an educational program, a modified CVC set, and a drape with reminder stickers. BMJ Qual Improv Rep. 2016;5(1):u209550.w3941. Doi: 10.1136/bmjquality.u209550.w3941. PMID: 27493743; PMCID: PMC4949605.

PARTICULARS OF CONTRIBUTORS:
1. Senior Resident, Department of Anaesthesia, Dr. SN Medical College, Jodhpur, Rajasthan, India.
2. Assistant Professor, Department of Anaesthesia, Dr. SN Medical College, Jodhpur, Rajasthan, India.
3. Associate Professor, Department of Cardiovascular and Thoracic Surgery, Dr. SN Medical College, Jodhpur, Rajasthan, India.
4. Assistant Professor, Department of Cardiovascular and Thoracic Surgery, Dr. SN Medical College, Jodhpur, Rajasthan, India.
5. Senior Resident, Department of Anaesthesia, Kerala Medical College Hospital Mangode, Cherpulassery, Palakkad, Kerala, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Devaram,
Assistant Professor, Department of Cardiovascular and Thoracic Surgery, Dr. SN Medical College, Jodhpur-342003, Rajasthan, India.
E-mail: devaramberar@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Dec 30, 2025
- Manual Googling: Jan 24, 2026
- iThenticate Software: Jan 27, 2026 (1%)

ETYMOLOGY: Author Origin

EMENDATIONS: 6

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Dec 04, 2025**
Date of Peer Review: **Jan 10, 2026**
Date of Acceptance: **Jan 29, 2026**
Date of Publishing: **May 01, 2026**