

Pinch Off effect: A lethal Unusual complication of Subclavian Hemodialysis Catheter in a Child

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Abstract

Pinch-off effect is reported as potential complications of subclavian venous access in 14 years old male child with hemodialysis catheter. Patient presented with features of luminal obstruction 8 months after insertion of hemodialysis catheter. X ray chest confirmed diagnosis of Pinch off syndrome. Replacement of Hemodialysis catheter through supraclavicular subclavian approach resulted in achieving safe and functional venous access for last 12 months.

Key words: Pinch-off syndrome, hemodialysis, Subclavian catheter, Supraclavicular approach, Long-term venous access, embolization.

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Introduction

The use of central venous catheters has become increasingly prevalent in the pediatric population which can be attributed not only to their introduction and widespread use in adults but also to technology advancement making small caliber catheters available for use in increasing surviving population of children with chronic diseases^{1,2}. While central lines are essential for providing vascular access for hemodialysis and other therapies, their placement and maintenance pose unique challenges in children¹.

The successful placement of long term central venous catheter is dependent on site of venous access for which internal jugular, femoral and subclavian veins are usually recommended in order of preference¹. Subclavian vein access remains least preferred site owing to associated complications like pulmonary injury, pneumothorax, hemorrhage and pinch off syndrome on long term follow up which may have lethal sequelae in form of catheter breakage and distal fragment dislodgement^{2,3,4}.

A review of literature suggests that pinch off syndrome has been scarcely reported in children with long term subclavian venous catheters with handful of cases being reported in English literature²⁻⁴.

The present article aims to highlight this potential lethal long-term complication of subclavian central venous catheter in children. Authors highlight the clinical presentation so that pinch off effect can be diagnosed at early stage along with highlighting the role of supra clavicular subclavian approach which can avoid pinch off effect and its associated sequelae.

Case Report

14 years old male child known case of end stage renal disease with post renal transplant graft rejection presently on hemodialysis through right subclavian venous access presented with pain during start of dialysis and intermittent mechanical obstruction getting relieved on elevation of right shoulder.

Past history suggested that patient remained on hemodialysis since age of 3 years and since then he has multiple attempts of hemodialysis catheter insertion. CT angiography showed stenosed both internal jugular and femoral veins with stenosis of left subclavian vein. Hence patient underwent insertion of hemodialysis catheter through right subclavian vein 8 months back.

X ray chest showed presence of grade 2 Pinch off sign (Figure 1). Considering the vascular status of patient, it was decided to replace catheter through right supraclavicular subclavian approach. Patient underwent replacement of Hemodialysis catheter through right supra clavicular subclavian approach and has been doing well for last 1 year.

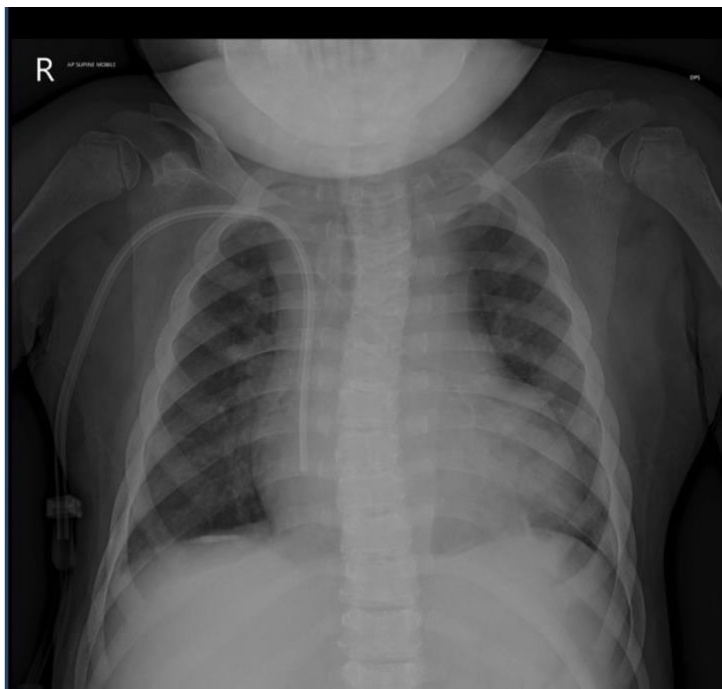


Figure 1: X ray chest showing grade 2 Pinch off sign

Discussion

The placement and maintenance of central venous catheters is challenging in pediatric age group owing to smaller anatomical structures and lack of self-awareness regarding catheter care.¹ Among central venous catheter related complications like infection, thrombosis, vessel stenosis, Pinch-off syndrome is rare and only associated with subclavian venous access²⁻⁴.

The subclavian venous access is the least preferred site in pediatric age group but is often considered as last resort in children with chronic illness where repeated attempts for central venous catheter insertion results in stenosis of other preferred vessels like internal jugular and femoral veins^{1,4}. The present article aims to highlight the life threatening sequelae of POS with subclavian venous access in children along with possible role of supraclavicular subclavian approach.

The pathophysiology of pinch off syndrome is explained on basis of mechanical compression of catheter as it passes through costoclavicular space, a narrow region between first rib and clavicle⁴. Anatomically subclavian vein passes between clavicle and first rib and more medial access results in passage of catheter through costoclavicular space before it pierces vein medially (Figure 1).^{3,4} Since anteromedial portion of canal is smaller than posterolateral region which contains subclavian vein so catheter with more medial access is vulnerable to compression between clavicle and first rib, thus, resulting in intermittent catheter dysfunction⁴. Further the compromise in dimension of costoclavicular space results from arm movements which cause intermittent continuous shearing force on catheter material thus resulting in catheter fracture over a period^{3,6}.

The clinical presentation of Pinch off syndrome is characterized by onset of symptoms 6 to 12 months after insertion^{3,5}. Most of patients present with signs of catheter dysfunction in form of resistance during infusion or aspiration, high pressure during hemodialysis, positional changes in catheter patency, localized pain at catheter site, shoulder or chest, occasional click sensation during arm movement^{2,4}. As experienced in present and reported cases intermittent mechanical obstruction remains most common presenting symptom in pediatric age group.

The diagnosis of pinch-off syndrome requires a high index of suspicion and a systematic approach involving clinical evaluation and imaging studies³. The diagnosis is confirmed on chest x ray and POS is graded based on Hinke's grading system (Table 1)^{4,6}. The grading system helps early detection and intervention so that life threatening complications like catheter fracture and embolization can be prevented.

Since subclavian vein is often considered as last available venous access in pediatric age group so management of POS always remains challenge and is often based on degree of compression Hinke's grading system (Table 2)^{3,4}.

Table 1: Hinke'S Classification of Pinch Off Syndrome

Grade	Description	Clinical Implication
Grade 0	No catheter narrowing	Normal; no compression
Grade 1	Abrupt change in catheter direction without luminal narrowing (catheter angulation)	Early mechanical stress; monitor for progression
Grade 2	Visible narrowing (compression) of the catheter lumen at the costoclavicular space	High risk of catheter fracture; intervention advised
Grade 3	Complete catheter fracture	Critical; catheter embolization may occur or has occurred; requires urgent retrieval

Pinch Off Effect & HD Catheter

The use of ultrasound-guided cannulation has been shown to improve the success rate of catheter placement and reduce complications. As experienced in present case supra clavicular subclavian vein appears to be an alternative approach which allows passage of catheter into subclavian vein without passing through costoclavicular space (Figure 2,3)^{7,8}.

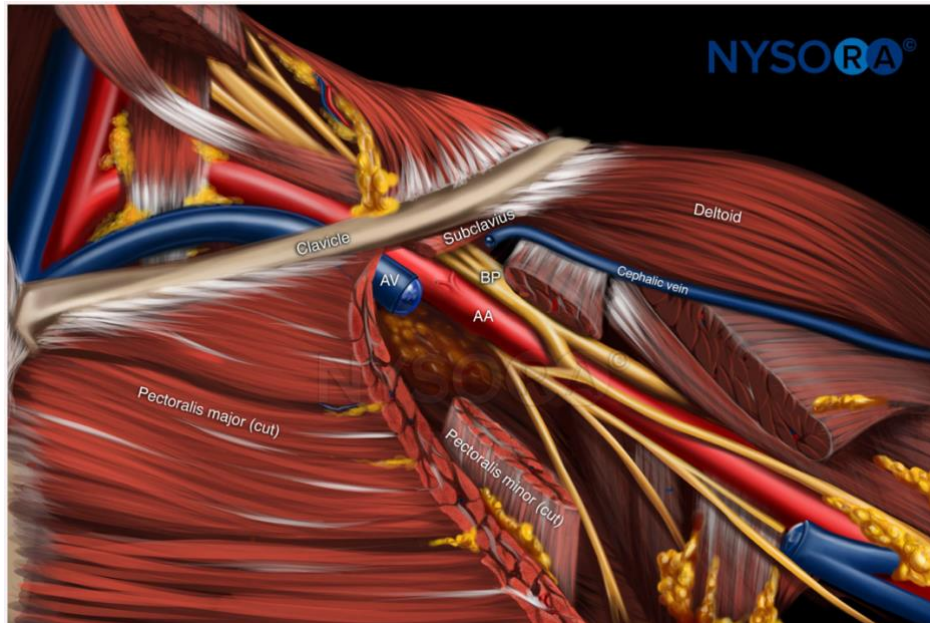


Figure 2: Anatomy of costoclavicular space in relation to Subclavian access. "NYSORA - Drawing Costoclavicular anatomy - English labels" at AnatomyTOOL.org by New York School of Regional Anesthesia and VisionExpo.Design, license: Creative Commons Attribution-NonCommercial-NoDerivs

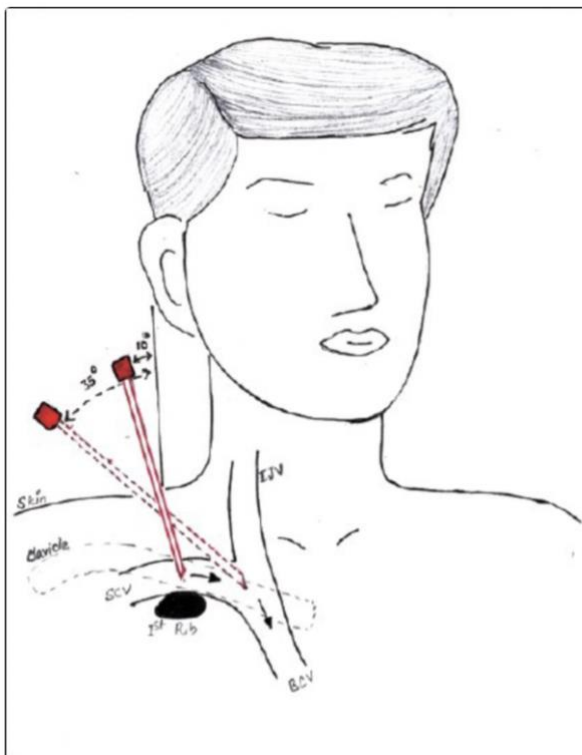


Figure 3: Supraclavicular Subclavian access avoiding costoclavicular space

POS can be prevented by avoiding more medial subclavian vein access during infra clavicular approach and considering supra clavicular approach if expertise is available.

Table 2: Interpretation and management of pinch off syndrome

Grade	Clinical significance	Management
Grade 0–1	Often asymptomatic	Close observation and regular follow-up imaging
Grade 2	Significant compression	Elective catheter replacement or repositioning
Grade 3	Lethal effect with possible catheter fracture	Catheter removal

Conclusion

We conclude that POS is rare but can be associated with life threatening complications in children with subclavian access. In children, early recognition is crucial due to their dependence on reliable vascular access for life-sustaining therapies such as hemodialysis. Appropriate catheter selection, ultrasound guided insertion avoiding medial access, use of appropriate size catheter with enhanced innovative durable catheter material and post-insertion care remain critical in minimizing risk of (Schummer, 2016). Preventive strategies include awareness among physician to avoid medial access or consider supra clavicular approach. Early recognition of signs of POS and grading on x ray chest helps in deciding management ranging from close monitoring to catheter removal in order to avoid risk of catheter fracture and embolization.

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Data Availability : No new data were generated or analysed in support of this research.

Ethical Statement: As per organization policy ethical approval is not required for case reports

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