Knot in the Cava—An Unusual Complication of Swan–Ganz Catheters


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Complications associated with the use of the Swan–Ganz catheters including coiling and knotting of the catheter in the central venous system or in the chambers of the heart, often with disastrous consequences. We report a case of knotting of a Swan–Ganz catheter in the superior vena cava which necessitated surgical removal via the right internal jugular vein.

Keywords: Intravascular knotting; Knots; Pulmonary catheter; Swan–Ganz.

Case Report

A 63-year-old gentleman was admitted for liver transplantation for cryptogenic cirrhosis complicated by hepatic encephalopathy, portal hypertension and oesophageal varices. He underwent uneventful liver transplantation with standard invasive monitoring with rapid infusion line, central venous access and Swan–Ganz pulmonary artery catheter all inserted into right internal jugular vein with no immediate complications (Fig. 1). He underwent pulmonary artery pressure measurements in the immediate post-operative period. His post-operative period was complicated by episodes of atrial fibrillation requiring treatment with amiodarone, non-cardiogenic pulmonary oedema, bilateral pleural effusions and methicillin resistant Staphylococcus aureus septicaemia.

On the seventh post-operative day, the pulmonary artery catheter was no longer required. On attempted removal, the catheter was found to be stuck and unyielding to moderate traction. A chest X-ray (Fig. 2) confirmed intravascular knotting of the Swan–Ganz catheter in the superior vena cava. The interventional radiologists’ were consulted to consider any non-surgical method of rescuing the catheter. Since, the knot appeared tight and ‘bow-tied’ it was felt that percutaneous attempts were unlikely to be successful.

The intensivists were advised to achieve left internal jugular venous access prior to surgical exploration. The right internal jugular vein was approached through standard approach anterior to the stern mastoid muscle (Fig. 3). The vein with the catheters in situ was controlled proximally and distally with slings. On traction, the pulmonary artery catheter yielded slightly and it was possible to feel the knot and the loop in the infraclavicular cava. With sustained moderate pull, the catheter was withdrawn with the knot into the lower neck. The venous access site was converted to a controlled venotomy to aid removal of the catheter and the venotomy was closed with continuous 4-0 prolene sutures. The rapid infusion line and the central line on the right side were still functioning. He remained unwell and developed multiorgan failure and died 25 days following his transplant. At autopsy, he was found to have diffuse hypoxic damage to the brain. Metabolic factors were thought to have contributed to his death. There was no evidence of any venous thrombo-embolic complications in relation to his internal jugular venotomy.

Discussion

The pulmonary artery floatation catheter was developed by cardiologists Swan and William Ganz and the use of this catheter in humans was published in the

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New England journal of medicine in 1970. It is estimated that approximately two million pulmonary artery catheters are used annually in the USA. Given the frequency of its use, one would expect sufficient body of evidence to support its use in the critically ill and unstable patients. However, the sparse evidence suggests greater risks in patients with Swan–Ganz catheters. Two observational cohort reviews found that patients in intensive care units who had Swan–Ganz catheterisation had higher death rates than those who did not. It has been suggested that use of the Swan–Ganz catheter to measure intracardiac pressures is a ‘good example of the clinically inexperienced being dependent on high technology’. Dalen in the editorial in JAMA called on the Food And Drug Administration to issue a moratorium on the use of flow directed catheters. The Canadian Critical care Trials group reporting a large randomised trial that compared pulmonary artery catheter use against control arm also concluded that there was no clinical advantage in elderly high risk patients undergoing major surgery. The controversy regarding the benefit of the pulmonary artery catheters has prompted the British intensivists to carry out a prospective randomised controlled study on their use.

The increasing frequency use of multiple central venous access catheters may result in an increase in the nature and complexity of the clinical challenges posed by their complications. Complications associated with the catheter insertion itself include pneumothorax/haemothorax, arterial laceration, cardiac arrhythmias, catheter knotting, valvular damage and rarely pulmonary artery perforation and false aneurysms. Complications associated with the presence of the catheter are: infection, pulmonary thrombosis/infarction, valvular damage/endocarditis, pulmonary artery perforation and thrombocytopenia from heparin coating of the catheters. Rarer complications include balloon rupture, balloon separation, Horner’s syndrome and osteomyelitis of the clavicle. Criticism has been raised regarding the intrinsic complications associated with their use by physicians inadequately trained in their placement, marginally skilled in obtaining the available data, and limited in their ability to interpret the data so obtained.

Knotting of intravascular catheter was first reported by Johansson et al. in 1954. Till date the number of reported cases exceeds just over 100. Of these, pulmonary artery catheters were responsible for more than two-thirds of the total of knotted intravascular catheters. Catheter knotting occurs as a result of intraventricular looping. In over two-third of instances, this problem could be remedied by interventional radiological means. The techniques employed vary and reflect the ingenuity of the clinician consulted. Surgery is reserved for cases of large ‘bow-tie’ knots or when intracardiac fixing of the knot is encountered. In extreme cases, the catheters have been left in situ with consequent high mortality.
Conclusion

Pulmonary floatation catheters are associated with significant morbidity and doubts have been raised regarding their use. We report a case of knotted catheter, which necessitated surgical removal. Knotting can be avoided by continuous visual control of the catheter tip during insertion and careful manipulation. The literature recommends interventional radiology for retrieving the knotted catheters and surgical intervention only in failed cases.

References


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