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Use of coronary hardware in peripheral vascular interventions: Necessity fostered ingenuity-Is it solution enough?

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ABSTRACT

In third world countries like India, where there is a paucity of dedicated interventional radiologists and training fellowships in peripheral interventions, it is the onus of the cardiologist to perform peripheral interventions. This coupled with logistic constraints of unavailability of medical insurance for majority of the population, makes it necessary to modify coronary hardware for use in peripheral interventions. Here, we discuss the modifications and simplifications performed to ensure optimal quality of clinical outcomes.

In the biblical battle between the Philistines and King Saul, David overcame Goliath with a shepherd's sling casting a stone at his forehead, killing him. This feat was accomplished without the use of the finest swords and other forms of weaponry prevalent in those times.This narrative provokes an analogy to medical care in third world countries, where judicious use of simpler and low cost techniques might contain the ever burgeoning cost of healthcare like the proverbial Goliath.

In developed countries like the USA, peripheral interventions are performed by interventional radiologists. In this system interventional radiologists pursue dedicated fellowship programs for training in peripheral vascular interventions. Cardiac interventions are performed exclusively by cardiologists.

This concept may not be applicable in third world countries like India, where the field of interventional radiology is still nascent, with very few specialists trained in this field.

Several hemorrhagic emergencies whethertraumatic, iatrogenic or secondary to a variety of pathologies portend a mortality of upto90% mainly due to lack of personnel with the required expertise. Peripheral interventions require a deep understanding of vascular anatomy of various vascular beds and dedicated specialized hardware. This increases the cost of the procedure considerably which may not be feasible in third world country populations not covered by health insurance.

In manysituations, coronary catheterscan be judiciously used in peripheral vascular beds with manual reshaping of the catheters whenever necessary.[1] The Judkins right coronary artery catheter is a particularly versatile catheter for peripheral angiography and interventions. In addition, it can easily be reshaped to resemble a Cobra catheter or other shapes. Knowledge of vascular anatomy is crucial to know what modifications are to be made: a tighter curve, reduced curve, or modification of the angle.Such reshaping of the catheters facilitate intervention in renal, superior mesenteric and coeliacarteries when the vascular anatomy is unfavorable.For example, with the femoral approach, cannulating the coeliac artery or the renal artery which often have a caudal orientation or thesuperior mesenteric artery whichalmost always has a sharp downward orientation might pose a challenge using coronary catheters, but the technique of reshaping often permits easy cannulation and deep engagement for sub-selective catheterization (Figs. 1 and 2). By reducing the primary curve, increasing the secondary curve and eliminating the tertiary curve of this catheter, it can readily access such arteries, facilitating subselective cannulation of some of the distal branches. This may obviate the need for a microcatheter and permit use of larger and less expensive embolisation material (gel foam pledgets/0.035 inch coils) in many instances, thus considerably reducing the cost of the procedure. In rare instances, a three dimensional curve may have to be made to subselectively enter a branch like the splenic artery or the hepatic or gastroduodenal arteries. (Fig. 2) or an S shaped compound curve to enter branch pulmonary arteries. Hydrophilic coated wires and also invaluable in advancing catheters into

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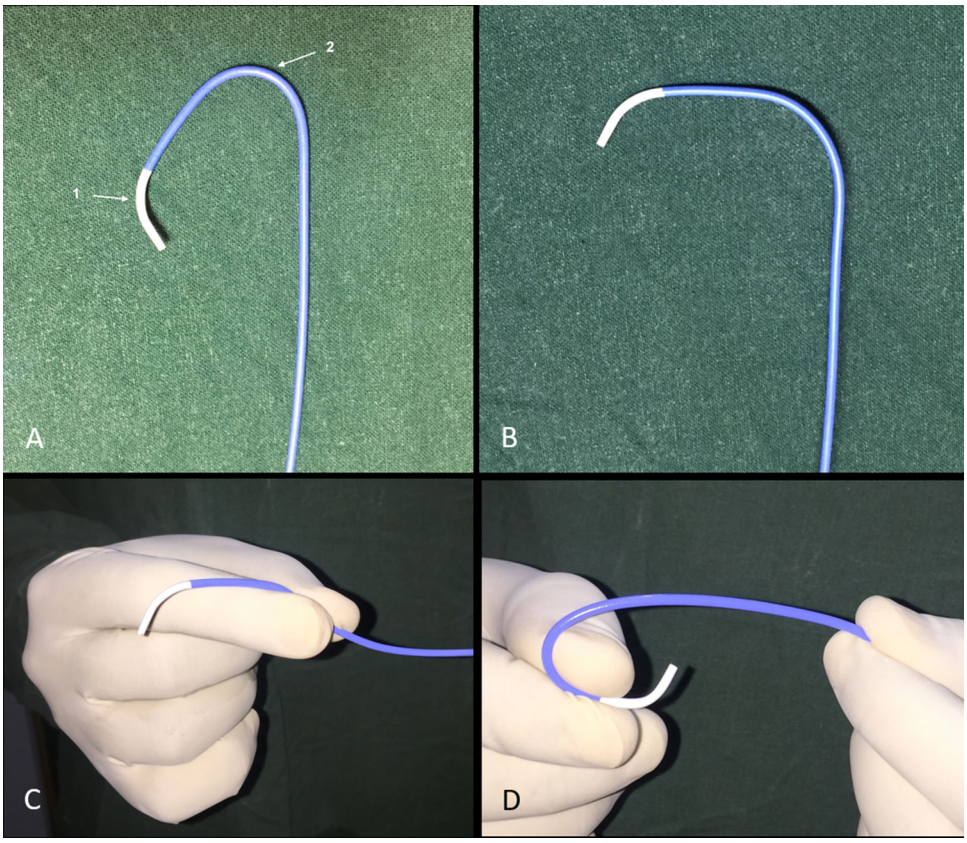

Fig. 1. Reshaping Catheters. A: The normal left Judkin's catheter with its primary and and secondary curves (1,2). B: Left Judkins catheter reshaped to reduce the secondary curve. C: Manually reducing the secondary curve of the Left Judkins catheter. D: Manually increasing the secondary curve of the Right Judkins catheter.

unfavourably oriented vessels.In children, trimming the distal curve of a IMA catheter may permit the selective cannulation and subsequent angioplasty of a renal artery with a sharp downward orientation.[1] The tail of the pigtail catheter also can also be trimmed to produce tight curves of varying angles.

Reshaping of catheters can be performed by various means, including hot water, steam or hot air. However, we find that the easiest way to reshape it is by using the operators fingers. Passing it between two fingers helps straighten the curve, or wrapping it around a finger helps to increase or tighten the curve. Catheters tend to regain their original curve when exposed to the warmth of the body, so one should try and cannulate the target vessel quickly. Occasionally, the stiff end of an 0.035 inch guidewire can also be used to straighten the curve of a catheter, making sure that the stiff end of the guide wire does not protrude beyond the tip of the catheter.

When considering an intervention on arteries with a sharp caudal orientation of therenal or splanchnic arteries, a radial or brachial approach permits easy engagementespecially when further subselective cannulation is required.

During embolization, care should be taken to subselectively engage the artery from which the culprit vessel arises, and avoid reflux during injection to prevent non-target vessel embolization. The use of larger embolization particles may also reduce the likelihood of remote ischemia. Spinal ischemia is a dreaded complication of bronchial artery embolisation and is often due to migration of embolic material into alternative vascular beds via small collateral channels which are often not readily visible.

In other situations involving splanchnic/renal arteries causing major bleeding complications, a single catheter often provides insufficient support and a catheter-in-catheter technique (mother and child technique) may assist inobtaining selective accessto the target vessel for embolization and for greater support during embolization.[2] These simple innovative techniques can be readily employed using reused catheters without increasing the cost of the procedure. Although most catheters are designed for single use, many centers routinely re-use such catheters after cleaning and re-sterilization, and such an approach has been shown to be feasible and safe.[4]

We work in a University teaching hospital in India, where most of the population is not covered by health insurance. Reuse of catheters and other hardware is often necessary for many patients requiring coronary and non-coronary interventions. However, we have a policy of not reusing most hardware especially coronary catheters more than three times.

In a trial in the USA, comparing re use of balloon angioplasty catheters according to stringent standards for maintain compliance and deflated balloon profile, there was no significant difference in procedural outcome compared to new catheters.[3] There was no pyrogenic reaction or neutrophilia reported. The re-use of balloon catheters decreased procedural costs by 40%. However, here the re-use was limited to once. Restoration to the manufacturer's original specifications enabledtheir use aloneor with adjunctive devices on all types of coronary angioplastylesions.

We have not had any instance of infection, pyrogen or allergicreactions attributable to the re-use of coronary hardware. Procedural success was not affected by re use of catheters.[4]

In our centre, over 300 peripheral embolization procedures have been performed involving various vascular beds from head to the foot for a variety of indications. These include preoperative embolisation of vascular tumors (eg: glomus tumors of the neck, nasal angiofibromas), chemo-embolisation of hepatic tumors, bronchial artery embolizations for massive hemoptysis, hepatic/

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