

Transluminal Angioplasty: An Attractive Alternate To Surgery Experience With Balloon Dilatation Of Abdominal Aortic Stenosis At Mayo Hospital, Lahore

M BUKHTIARI N H MALIK N ANJUM S SHAIKH

Jinnah Hospital/Mayo Hospital/PGMI, Lahore.

Correspondence To :Dr. Mansoor Bukhtari, Radiologist, Jinnah Hospital, Lahore

Percutaneous transluminal angioplasty (PTA) with balloon catheters has been available for almost 25 years. Initially applied to the peripheral vascular system, PTA is now technically feasible in almost any vessel that can be catheterized. PTA of abdominal aorta is not commonly performed because isolated aortic atherosclerotic disease is not usual. Aorto-iliac or aorto-femoral bypass grafting is the indicated procedure in diffuse or multi-focal aorto-iliac disease. Angioplasty is the indicated procedure for focal infra-renal aortic stenosis or focal disease of the aorto-iliac junctions. A study of 18 patients undergoing abdominal aortic PTA between November 92 and Nov 97 at catheterization Lab Mayo Hospital is reported. Success rate was 80% with almost complete relieve of symptoms, 13% partial relieve, 7% recurrence rate, 0% complication rate. This high success rate indicate that PTA has a major contribution to make in the management of stenotic abdominal aortic disease. Advantages include low morbidity and mortality, short rehabilitation time, can be repeated at ease if necessary and seldom precludes surgical management if PTA fails.

Key words:- Percutaneous transluminal angioplasty (PTA), Balloon Catheters.

For the first time in 1964 Dotter and Judkins¹ described the dilatation of vascular stenosis by percutaneously introduced catheters using coaxial system of catheters giving progressive dilatation of vessels. Success rate was variable and complication rate was significant due to which this system could not gain wide spread acceptance. In 1976 Gruntzig² developed a catheter with polyvinyl balloon at its tip (Fig 1), permitted a more effective radial dilation force to be exerted on a lesion and by using appropriate size catheters, up to six atmospheric pressure was achieved without overdistension of balloon.

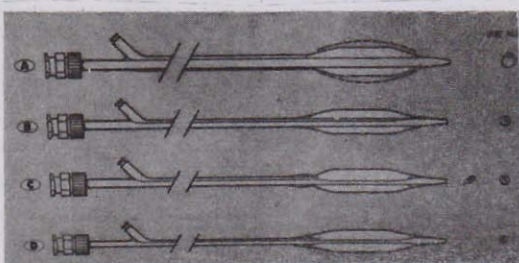


Fig 1: The polyvinyl chloride catheter shaft is surrounded by another very thin walled tube of polyvinyl chloride with an expanded end which corresponds to the balloon.

Encouraging results were reported in lower limb arterial disease (Gruntzig, 1979³). Since then substantial evidence has accumulated to indicate that Percutaneous angioplasty is, in selected patients, an attractive alternative to surgery. To date there has been no Pakistani series reported upon abdominal aortic angioplasty. This paper summarizes the author's experience in percutaneous angioplasties of abdominal aorta.

Patients & Methods:-

A total of 18 angioplasties were performed in 18 patients (11 males, 7 females, age range 20-70 years), over a period of about 5 years, comprising of 13 atherosclerotic aortic stenosis (Fig 2), 2 muscular dysplasias, 2 vasculitis, and 1 post surgical intimal hyperplasia.



Fig 2: Aortic PTA of Atheromatous Aortic Stenosis

In all cases of abdominal coarctation, stenosis were focal, 15 were below renal arteries, other at aorto-iliac junction. Angioplasty is the indicated procedure for focal infra-renal aortic stenosis or focal disease of the aorto-iliac junction. Symptoms of claudication, rest pain or a gangrenous preamputation were the main indication.

In this series all angioplasties were performed through percutaneous cathetrization of femoral artery under local anaesthesia. A diagnostic angiogram that clearly depicts the stenosis and the circulation distal to it, directs the choice of guide wire and balloon catheter, and

provides a base line for assessment of technical success of the procedure and evaluation of procedural complications. Premedication was given as for an angiographic procedure. In addition 10mg of Nifedipine is given sublingually at least 30 minutes before the procedure. Nitroglycerine and heparin kept ready on the angiographic tray. A diagnostic catheter was introduced through a puncture site. The catheter was advanced to the level of the stenosis. Five thousand units of heparin were administered and the location and length of the lesion were clearly marked with radio-opaque marker or bone marks. Initially brief attempts were made to cross the stenosis with straight wires but use of highly torquable soft tipped guide wire were more successful. After the guide wire has crossed the lesion, a tapered predilating catheter was advanced over the guide wire and the wire was removed. Additional vasodilator or anticoagulant were administered at this time. A heavy duty guide wire then advance through the catheter and positioned so that its tip can be fluoroscopically monitored during catheter exchanges. The diagnostic catheter was removed and replaced with a balloon catheter chosen to match the diameter of the blood vessel as measured on a non-magnified angiogram, a reduction 10-20% being made to give a safety margin. Balloon dilatation of normal vessels produces accelerated atherosclerotic plaque deposition. Therefore balloon length was matched as closely as possible to the length of lesion to be dilated to minimise the damage to non-stenotic vessel subjected to the balloon dilatation. In Stenosis sufficiently proximal to the aorta bifurcation, to allow balloon inflation in the aorta without extending it into the common iliac artery, a single 15 to 20 mm balloon was used. Balloon of this size obviously could not be inflated in the iliac arteries without significant risk of rupture. When the stenosis was near the aorto-iliac junction, bilateral femoral puncture were used to insert two angioplasty balloons whose size was chosen to match the limitation of common iliac artery diameter. Generally this allowed two 8 to 12 mm balloons to be positioned at the aorto-iliac junction and simultaneously inflated, producing a large aortic lumen without risking iliac rupture.

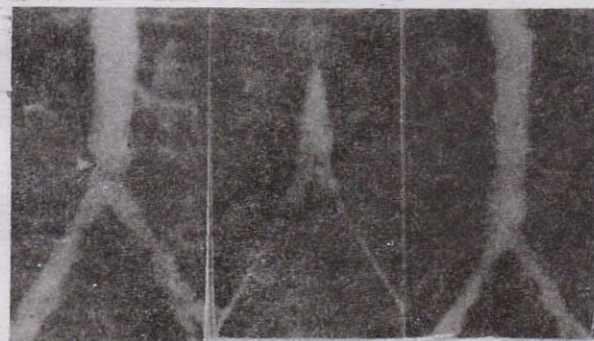


Fig3: Double-balloon technique

A). A focal stenosis of distal abdominal aorta (arrow) produced bilateral claudication. The lesion was too close to the iliac arteries to allow safe dilatation with an adequate size balloon.

B). 8mm, 3cm balloons were placed from bilateral femoral artery punctures and positioned at the level of the stenosis with their proximal portions extending into the common iliac arteries.

C). Post PTA angiogram demonstrate that normal aortic diameter has been re-established without damage to the iliac arteries.

The balloon was then centred over the lesion and was slowly inflated to full diameter using a 10cc syringe for 10-15 seconds, at the pressure of up to 6 atmosphere. 15 to 30 seconds of inflation appears to achieve successful stretching of the vessel walls without prolonged stasis which could encourage the thrombosis. The balloon inflation was kept to minimum number of times required to dilate the full length of the stenosis. It was mandatory to deflate the balloon fully for any adjustment for additional inflations. Progress of procedure was assessed by the intra-arterial pressure monitoring, the end point being when the gradient across the lesion had been completely removed or when further inflation had no more effect.

After final inflation, check angiograms were always performed with angioplasty catheters. Post PTA angiograms were performed in the same projections that best showed the vessel in the pre-PTA angiogram. A residual stenosis of 30% or less at the angioplasty site and subjective assessment of flow through the lesion were the criteria of success; as the pressure measurements were not helpful. During procedure 1-2cc of lignocaine was used mixed with contrast for angiogram to relieve spasm and associated pain. Post procedure drug treatment included 5000 units of intraarterial heparin. All the patients received antiplatelet regime of Ascord 75mg daily and persantin 100mg t.i.d for at least two days before and two months after the procedure.

Results:-

Technical success was achieved in 80% cases of abdominal aortic stenosis. Success rate was 80% with almost complete relieve of symptoms, 13% partial relieve, 7% recurrence rate. No complication occurred in our series, the reported complications was iliac thrombosis, usually from subintimal passage of guide wires¹³, other rare complication reported was aortic rupture. Long term follow up is not available but one would expect a low restenosis rate <10% in the large high low vessel. Impotence which follows aorto-iliac surgery in up to one third of the patients, does not occur with angioplasty (Berger, Casaneder-Zunig 1982)^{5,6}.

Discussion:-

Early investigators believed that balloon angioplasty increased the lumen diameter at a point of stenosis by compressing and rearranging the atherosclerotic plaques. Further investigation provided that atherosclerotic plaques are very firm, non-compressible lesion with very little water content (Chin, 1984⁸). Angioplasty actually desquamate the endothelium, splits the intima, either through the thin portions of a circumferential plaque or along borders of an eccentric plaque. Further dilatation causes separation of plaque from the media, with stretching and rupture of the muscle fibers. The adventitia is stretched irreversibly thus expanding the outer diameter of the vessel. This increase continue further over the next few weeks due to retraction of the plaque material and formation of a fibrous neo-intima.

Over distension of vessels can produce complete separation of the plaque from the media with risk of distal embolization of plaque or tearing of the adventitia, causing bleeding or pseudo-aneurysm formation (Castaneda-Zuniga, 1984⁶). The body responds quickly to the trauma of balloon angioplasty by covering the damaged intimal surface with platelets within several hours. When the internal elastic membrane is damaged, exposing the media, platelet deposition is more intense. Platelet deposition is increased when there is residual stenosis. Platelets also elaborate vasoconstrictive substances which mediate spasm distally. Platelet aggregation is liable to occur at least for a few weeks, therefore antiplatelet drugs or anticoagulants are indicated. It was common to see linear filling defects at the angioplasty site, representing the portions of disrupted intima and media, outlined by the contrast on the both sides. These intimal and medial cracks were not permanent and usually have no clinical significance as post angioplasty healing and remodeling regenerate a smooth intimal surface (Korogi, Takahashi⁹). As these cracks represent local wall dissection, meticulous attention to technique is required to minimise the incidence of subintimal passage of the guide wire or catheter at the lesion, immediately after intimal split has been produced. To avoid subintimal passage of guide wire or catheter following simple technique is adopted, after the balloon catheter has initially passed through the lesion, a fine guide wire was introduced and kept permanently through the stenosis, thus maintaining the catheter on an intraluminal course if repassage through the lesion was necessary or if the catheter has to be withdrawn proximal to this lesion to check the results. Similarly post angiography injections should never be

made within dilated segments to avoid propagating dissection (Cumberland DC¹⁰). Present study and current literature emphasize that provided the current high patency rate continues in long term follow up, percutaneous angioplasty will make a major contribution to the treatment of arterial diseases. Angioplasty can be a direct substitute for surgery in some patients or combined with it in patients with multiple disease. Angioplasty can be attempted in patients medically unfit for surgery. If carefully performed the morbidity is small, both in terms of complications and rehabilitation time. Recurrent stenosis usually responds to repeat angioplasty (Radiology, 1980). If failure does occur the preclusion of future surgical treatment is very unlikely.

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