Flexible hollow catheter for tunneling thru vessel obstructions

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Thromboembolic disease accounts for half of all hospital admissions. Current therapy is either medical (anticoagulation) or surgical (endarterectomy). Each has its own particular disadvantages. Moreover, there are many anatomical sites that cannot be reached by the surgical knife. The Gruntzig balloon catheter can only be used in incomplete vessel obstructions.

The author describes a new invention called a "laser catheter" wihch has these capabilities:

1. Direct visualization via coherent fiberoptics.

2. It can be introduced percutaneously and threaded to the site of vessel obstruction under fluoroscopic guidance.

3. Laser energy can be conducted through the fiberoptic core and concentrated into a cone which vaporizes the obstruction.

4. Heat and gases generated are removed through continuous suction via the hollow catheter.

5. At the end of the procedure, patency of the vessel can be demonstrated by (a) direct inspection, and (b) by injecting a radio-opaque dye through the catheter and performing fluoroscopy.

Slides showing invitro tunneling through of blood clots with an argon laser will be shown.

The fiberoptic iaser tunnelling device consists of a fiberoptic bundle encased in a semi-flexible tube designed to transmit laser energy to the nozzle end of the tube. The other end of the tube is attached to suction and a transparent reservoir. Proximal to the entry of the fiberoptic bundle into the tube is an inlet with a two-way valve for the introduction of saline or radioopaque material. The fiberoptic bundle is divided into a laser conducting portion and a viewing portion.

The mode of operation:

1. The device is introduced into an occluded vessel through a surgical incision and advanced until the nozzle meets the obstruction (thrombus).

2. Radioopaque material is injected, and the position of the nozzle is checked by angiography.

3. The radioopaque material is then flushed out with saline and removed by suction.

4. Direct inspection of the thrombus is then performed with light introduced through the laser portion of the fiberoptic bundle and reflected through the viewing bundle.

5. Suction is then turned on and this serves to attach the nozzle firmly to the clot.

6. The laser beam is turned on, vaporizing a path through the clot.

7. Suction removes the vapors and at the same time helps to advance the catheter.

8. When breakthrough occurs, liquid blood is sucked back and appears in the transparent reservoir.

9. This is the end point, and the laser is turned off.

10. The catheter is withdrawn a short distance, and angiographic proof of vessel patency is achieved by injection of radioopaque material.

Immediate applications which come to mind include tunnelling through blocked coronary and carotid arteries, common bile ducts, ureters, etc.

凿隧血管阻塞的活动空心导管

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血栓栓塞疾病占所有住院人数的一半。目前的治疗是应用抗凝药物或外科的脉内膜切除术，但二者各有其特殊缺点。再者，有许多解剖部位手术刀不能到达。Gruntzig 气球状导管仅能应用于血管不完全阻塞。

作者发明一种新的"激光导管"，具有下列性能：

1. 通过粘着的导光纤维可直接窥视。

2. 在萤光镜的指引下，可通过皮肤进入血管阻塞部位。

3. 激光能量可通过导光纤维内芯传导并集中为锥状，将阻塞物气化。

4. 产生热和气体可通过空心导管连续吸引而去除。

5. 操作结束时，血管开放可提供直接检查和通过导管注射放射性不透明染料并行萤光镜检查。

幻灯片显于在活体外用氩激光通过血块凿隧。

导光纤维激光凿隧装置由装入一半灵活管中的导光纤维束组成。目的将激光能量传送给管的嘴端。管的另一端附有吸引器和一透明贮器。邻近导光纤维进管处有一入口，它有二路活门以便注入盐水或放射性不透明物质。导光纤维分为激光传导部分和观察部分。

手术方式：

1. 装置通过外科切口进入闭塞血管，并继续前进直至与阻碍物(血栓)相遇。

2. 注入放射性不透明物质，并且以血管造影术检查管嘴部分。。

3. 然后用盐水冲洗放射性不透明物质，并用吸引器去除。

4. 用通过导光纤维激光部分引进的和通过观察束反射的光直接观察血栓。

5. 然后开动吸引器，目的使管嘴牢固地附着血块。

6. 启动激光，通过血块气化一条通道。

7. 用吸引器排除烟雾，并同时促使其进入导管。

8. 当阻碍物冲去时，血液被吸回，并出现在透明的贮器内。

9. 手术到此结束，关闭激光器。

10. 导管拉出一小段，并注入放射性不透明物质，以血管造影术证实血管开放。

目前所能想到的应用范围包括阻滞的冠状的脉、颈动脉、胆管和输尿管凿隧。