

ANGIOGRAPHY AND INTERVENTION IN ABDOMINAL ORGAN INJURY: WHEN AND HOW?

Nils-Einar Kflov, Professor

Injury to the solid abdominal organs is quite frequent. Percutaneous catheter intervention may help to stop the bleeding, preserve the organ and reduce the rate of complication compared to operative management. At UUS there were 149 injuries to the spleen over four years, 138 injuries to the liver, and definitely lower numbers of kidney injuries in adults. There are diagnostic challenges when choosing the optimal therapy for these often multitraumatic patients, as well as the time of intervention. CT abdomen play an important role in the diagnostics. The timing of treatment depends on general condition of the patient, bleeding status and hemodynamic stability.

Angiography

Angiography is used when the CT examination demonstrate findings that need further therapy with embolization. Indications for angiography at UUS are Organ Injury Scale (1) grade 3 or more of the spleen and OIS grade 4 - 5 of the liver. Any active arterial bleeding and pseudoaneurysm do have an angiography whatever the grade. If possible the patient should be stabilized before transport to the angio suite.

The angio team which includes one doctor and one radiographer has 24 hour home call. Response time is 30 minutes. The diagnostic angiography always starts with a 5-6F femoral sheath. The diagnostic catheter used in most cases is the selective end-hole catheter with the cobra curve. Alternatives are the reverse curve catheter (Simm). The protocols depend on CT findings. Selective contrast injection is only injected into the main artery of the injured organ. Long filming is used to demonstrate extravasation and vascular abnormalities such as occluded branches, pseudoaneurysms and AV-shunting. Whenever the bleeding is not found on the initial films, the catheter is advanced peripherally using either the diagnostic catheter or a microcatheter. Multiple projections may be required.

Intervention

Therapeutic intervention of abdominal solid organs is embolization of the arteries. Only in rare cases an injured artery may be repaired with stent and stentgraft.

Indications for embolization various between the organs. There are no uniform evidence based indications. Our recommendations are based on literature search, own experience and own publications. The methods of embolization various because collaterals and thereby the risk of necrosis varies between the organs. Embolization materials are coils and gelfoam (spongostan). The material may be delivered through diagnostic catheters or through microcatheters.

Spleen (2,3): OIS grade 3-5, ongoing bleeding, and vascular abnormalities (extravasation, pseudoaneurysms, AV fistula) are treated during the acute phase. The patient should be hemodynamically stable or stabilized before angiography. Delayed bleeding or PSA at follow-up CT is also an indication. Children under 15 years old are only taken to the angio suite when ongoing bleeding.

The spleen has good collaterals and embolization of the proximal artery can be done nearly without the risk of necrosis. We therefore embolize all OIS grade 3-5 centrally. In addition, embolization of peripheral branches should be done when vascular damage of these branches, but has a higher risk of necrosis.

Liver (4): OIS grade 4-5, ongoing bleeding, and vascular abnormalities on CT are eligible for angiography. We may also do angiography after operative external packing. The liver is supplied with blood from both the arteries and the portal veins. Theoretically the whole arterial tree can therefore be embolized without necrosis when portal system is open. There is one exception; the arterial supply to the gall bladder does not have collaterals and embolization may result in fatal necrosis. In a certain number of cases there will be necrosis also peripheral to arterial occlusion of the liver parenchyma. Therefore, we only embolize when the injured artery is found.

Kidneys: We do only few cases yearly. The reason is that most bleedings are self limited. Indications are extravasation of contrast and PSA during CT, and

hemodynamically unstable patient. The renal arteries are end-arteries. Embolization of the renal arteries will result in necrosis. To limit the extent of necrosis, it is important to do occlude the renal artery as peripheral as possible. Exact placement of embolization material is technically more difficult than in the spleen and the liver.

Results

Liver: Recent publication (2) from our center of 138 adults has shown that angiography and embolization have increased NOM from 51% to 76% with no increase in mortality. The laparotomy rate fell from 58% to 34%. The overall complication rate per patient decreased from 1.5 to 0.9.

Spleen: Recent publication (3) from our center of 149 adults has shown that angiography and embolization have increased NOM from 57% to 73% with no increase in mortality. The laparotomy rate fell from 55% to 30%. The spleen salvage rate increased from 57% to 75%.

Reference List

1. Moore EE, Cogbill TH, Jurkovich GJ, et al. Organ injury scaling: spleen and liver (1994 revision). *J Trauma*. 1995; 38: 323–324.
2. Gaarder C, Dormagen JB, Eken T, Skaga NO, Klow NE, Pillgram-Larsen J, Buanes T, Naess PA. Nonoperative management of splenic injuries: improved results with angioembolization. *J Trauma*. 2006 Jul;61(1):192-8.
3. Gaarder C, Naess PA, Eken T, Skaga NO, Pillgram-Larsen J, Klow NE, Buanes T. Liver injuries--improved results with a formal protocol including angiography. *Injury*. 2007 Sep;38(9):1075-83.
4. Hager AM, Klow NE, Gaarder C, Naess PA, Dormagen JB. Pseudoaneurisme ved miltskader. *Tidsskr Nor Laegeforen*. 2005 May 19;125(10):1336-7.