

Doppler-guided hemorrhoidal artery ligation (DG-HAL): a safe treatment of II-III degree hemorrhoids for all patients. Could it be potentially also good prophylaxis?

A. TESTA¹, G. TORINO²

Aim. Doppler-guided hemorrhoidal artery ligation (HAL Doppler) is an innovative hemorrhoid treatment mainly utilised for II-III degree where bleeding is a predominant symptom. This procedure aims at dearterialization of the internal hemorrhoidal plexus by ligation of the terminal branches of the superior rectal artery detected using a special proctoscope and ultrasound system; the procedure is performed entirely above the dentate line, so it is genuinely painless. The aim of this study was to evaluate the efficacy, safety and invasivity of HAL Doppler technique to treat II and III degree hemorrhoids.

Methods. The authors treated 148 patients, from May 2002 to December 2007, principally affected by II-III degree hemorrhoids characterized by bleeding and pain at evacuation. These patients were examined in a retrospective observational study of 128 patients, 86% of the group. Follow-up varied from 5 up to 72 months with an average observation time of 36.5 months.

Results. Success was registered in 90% of patients affected by II-III degree hemorrhoids and the absence of major complications (hemorrhage, incontinence, stenosis, perforation, sepsis).

Conclusion. The authors suggest the safety, efficacy and low invasivity of HAL Doppler for treatment of II-III degree hemorrhoids, which also found in the literature, and highlight its use in treating patients with unhealthy conditions

¹Department of Surgery, S. Peter Hospital
FBF, Rome, Italy

²Pediatric Surgery Unit, G. Salesi
Children's Hospital, Ancona, Italy

which are a contraindication to the usual surgical treatments. Moreover, they suppose the use of HAL Doppler in low degree hemorrhoids as a therapeutic and also prophylactic rule of advanced degree.

Key words: Doppler - Hemorrhoids - Hemorrhage - Vascular factor.

The treatment of hemorrhoidal pathology gains interest. This is due to diffusion in the population and to a constant search for more effective, less traumatic methods principally free of risk of early or later complications. Some postoperative complications are often more problematic than hemorrhoidal disease symptomatology as described in literature. Further, these complications are often difficult to resolve: cases of fatalities were also recorded.¹⁻³

Considering this it is easy to understand the recent tendency to seek methods of operation which treat the early stages of hemorrhoidal disease where, the hygienic-behavioral therapy together with pharmacological support are ineffective with the symptomatology and the quality of life.

Received on September 30, 2009.

Accepted for publication on June 1, 2010.

Corresponding author: A. Testa, MD, via Cassia 987, 00189 Rome, Italy. E-mail: al.testa@tiscali.it

In our opinion, the HAL Doppler, was a brilliant, distinctly innovative invention for treatment of hemorrhoidal pathology. The method was created by the Japanese Morinaga;⁴ he described the experience of patients affected by hemorrhoids with bleeding on a 1995 publication. Morinaga was able to detect the branches of the upper and median hemorrhoidal arteries in those patients, using Doppler technology applied to a proctoscope. He then performed sutures on the vessels with absorbable stitches verifying the consequent disappearance of the sphincteric wave in an immediate Doppler check.

This produced reduced perfusion relative to the correspondent haemorrhoidal, both immediate and significant. The result, visible to the patient, was a drastic reduction or indeed disappearance of the bleeding symptom from the early postoperative days.

Diverse interesting publications appeared about the encouraging results obtained in several series of cases in North American⁵ and European centers,⁶⁻¹⁰ as described in the literature of the recent years. This aspect, together with the persuasion that the vascular aspect is definitely the core factor in hemorrhoidal pathogenesis, led us to use HAL Doppler for selected patients, obtaining totally satisfactory results on the whole.

The aim of this study was to evaluate the efficacy, safety and invasivity of HAL Doppler technique to treat II and III degree hemorrhoids.

Materials and methods

The study enrolled 148 patients who underwent HAL Doppler from May 2002 to December 2007: 128 (86%) were included in our retrospective observational study; they were homogeneous by gender (60 males, 68 females), and heterogeneous by age (25 to 78 years); 28 (22%) showed II degree hemorrhoids, 92 (72%) showed III degree hemorrhoids, and 8 (6%) had IV degree hemorrhoids (sec. Goligher). A total of 116 out of 128 cases treated were primitive hemorrhoids and 12 were relapses (8 cases after multiple sessions of rubber band ligation and 4 after

TABLE I.—*Total cases inserted in follow-up: 128.*

II degree hemorrhoids	28/128 (22%)
III degree hemorrhoids	92/128 (72%)
IV degree hemorrhoids	8/128 (6%)
Primitive	116
Relapses	12

TABLE II.—*Preoperative symptoms.*

Pain at evacuation	104/128 (81%)
Bleeding	120/128 (94%)
III-IV degree prolapse	100/128 (78%)

TABLE III.—*Number of vessels stitched for surgical session.*

4-6	16 (13%)
6-8	100 (78%)
8-10	12 (9%)

hemorrhoidectomy sec. Milligan Morgan) (Table I).

One-hundred and four patients (81%) had preoperative pain at evacuation, 120 (94%) had bleeding and 100 patients (78%) had a prolapse of III and IV degree (Table II).

The operation was performed under in laryngeal mask in 114 cases (89%).

A perioperative colonoscopy was effected in 106 cases, and local anesthetic was used in 14 cases (11%), using a 33% Naropin solution (perineal procedure sec. Marti) with sedation (propofol or ipnovel). The duration of the operation varied from 25 to 45 minutes.

As to the number of ligatures performed, 4 to 6 ligatures were inserted in 16 cases (13%), 6 to 8 ligatures in 100 cases (78%), and 8 to 10 ligatures in 12 cases (9%) (Table III).

The patients were discharged on the day of the operation (at least 6 hours after the operation) in 20 cases (16%), and the morning after in the other 108 cases (84%) with reference "one day surgery" procedure.

A total of 16 surgical procedures (12%) were performed simultaneous to the DGHAL; 8 due to the presence of anal fissure (fissure excision and minimal internal sphincterotomy) while 8 were due to the presence of a polypus in the anal canal (excision).

TABLE IV.—*Postoperative pain analysis at one week.*

No pain	96/128 (75%)
Pain for three days	16/128 (12%)
Pain up to seven days	8/128 (6%)
Pain after seven day	8/128 (6%)

TABLE V.—*Return to normal daily activity after surgery.*

Within first three days	56/128 (44%)
Within first seven days	44/128 (34%)
After seven days	28/128 (22%)

The average follow-up was at 36.5 months and, performed as follows: the first check was performed 12 hours after the operation first verifying pain and post-operative bleeding or hematoma *via* rectal exploration. Painkiller consumption was analysed (Ketorolac 30 mg e.v.), urinary function, and the presence of rectal tenesmus.

The next visit was seven days later with examination of changes in preoperative symptoms, especially for bleeding, and considering postoperative symptomatology connected with surgical intervention.

Further follow-up visits were effected up to six months and then annually.

All patients selected for the study were contacted in May 2008, and asked a set of questions about bleeding, postevacuation pain, prolapse, and their degree of satisfaction with the procedure and continence.

Statistical analysis

A statistical evaluation of the results was performed with the χ^2 test.

Results

No cases of postoperative hemorrhage or of urinary retention were recorded at the initial postoperative visits within 12 hours of the operation. Analysis of postoperative pain indicated an absence of pain in 96 of 128 patients after one week; while 16 patients (12%) reported pain in the first three days required a daily 10 mg dose of Ketorolac.

TABLE VI.—*Total recurrences and its distribution.*

Total recurrences	20/128 (16%)
Recurrences in IV degree haemorrhoids	8/8 (100%)
Recurrences in III degree haemorrhoids	12/92 (13%)
Recurrences in II degree haemorrhoids	0

TABLE VII.—*Disappearance of preoperative bleeding after HAL Doppler.*

Total disappearance of bleeding	100/120 (83%) (P<0.001)
50% disappearance of bleeding	8/120 (7%)
Persistent bleeding	12/120 (10%)

There was pain up to the seventh day in 8 patients (6%) and beyond the seventh day for a further 8 patients (6%) with additional procedures who took a daily 30 mg dose of Ketorolac (Table IV).

Of the 104 patients with preoperative pain, 96 indicated a complete absence of pain after the HAL Doppler procedure after the first week (P<0.001).

No case of postoperative hemorrhage was recorded up to the latest check.

As to a return to daily activities, the team noticed that 56 patients (44%) returned to their regular activities within three days of the operation, 44 patients (34%) by the seventh day, and 28 patients (22%) returned to their regular activities after a week (Table V).

All relapses in the group, 20 patients (16%) were registered at the six-month follow-up. They were distributed as follows: eight patients in the IV degree hemorrhoids group (100%), 12 patients in the III degree hemorrhoids group (13%), no patients with II degree hemorrhoids had a relapse (Table VI).

The postevacuation bleeding present preoperatively in 120 patients disappeared completely at the six month check in 100 patients (P<0.001); 50% disappearance of bleeding was observed in eight patients (7%), and persistent bleeding in 12 patients (10%) (Table VII).

With reference to prolapse regarding 100 patients, 92 cases of III degree prolapse were examined: total resolution was registered in

TABLE VIII.—*Resolution of III degree prolapse after HAL Doppler.*

Total resolution	60/92 (65%) (P<0.001)
50% resolution	20/92 (22%)
Persistence of prolapse	12/92 (13%)

TABLE IX.—*Postoperative complications.*

Fissure	8/128 (6%)
Proctitis	4/128 (3%)
Thrombosis	4/128 (3%)
Urinary retention	0
Postoperative bleeding	0
Postoperative stenosis	0
Postoperative incontinence	0
Sepsis/abscesses	0
Iatrogenic perforation	0

TABLE X.—*Degree of satisfaction.*

High satisfactory	84/128 (66%)
Reasonably satisfactory	24/128 (19%)
Not particularly satisfactory	4/128 (3%)
Dissatisfaction	16/128 (12%)

60 patients (P<0.001), a 50% reduction in 20 patients (22%), and no improvement in 12 patients (13%) (Table VIII). There was relapse in 100% of the 8 patients affected by IV degree hemorrhoids.

As to complications, the appearance of postoperative fissures was observed in eight cases (6%): four were treated by surgery (excision), the other four with anal dilatation.

Four cases of hemorrhoidal thrombosis were observed in certain patients who used steroid drugs and all these cases were resolved with medical therapy.

Further, four cases of proctitis were recorded and were treated with topical antiinflammatory drugs.

It can be stated that other complications as rectal anal stenosis, incontinence, abscesses, iatrogenic perforation of the rectum, were not present in our cases (Table IX).

In our opinion, a significant parameter for

evaluation of the HAL Doppler, is the degree of satisfaction expressed by patients. Eighty-four (66%) stated that they were satisfied, 24 (19%) reasonably satisfied, four patients (3%) not particularly satisfied while 16 patients (12%) said they were dissatisfied (Table X).

No change in the results recorded at six months, was observed during the annual check up.

Discussion

Hemorrhoidal pathology is an area in constant development in terms of diagnostic description and treatment, aiming at achieving better, more concrete, lasting results using increasingly less traumatic techniques. At present hemorrhoidal pathogenesis is the subject of controversy. On the one hand there is a theory which recognizes alteration of the Parks ligament, the support frame of the internal hemorrhoidal plexus, as the "primum movens" of hemorrhoidal prolapse, which is responsible for the symptomatology sequel in its most advanced stages.^{11, 12}

On the other, several studies regarding the vascular anatomy of the rectal anal canal support a different theory. The most interesting of these is the work carried out by Aigner in 2006.^{13, 14} He subjected a group of patients with the four different degrees of pathology (sec. Goligher) to Doppler research of the distant branches of the upper haemorrhoidal artery. Aigner compared them with a group of patients who were included in the check, not affected with the pathology. The study highlighted a structural alteration in the branches examined. In the first group of patients, the branches had augmented calibre and were bearers of greater arterial flow to the entire haemorrhoidal plexus. The factor examined is called "vascular" and it becomes increasingly important in direct proportion to the degree of the illness studied. In Aigner's paper, the values of both calibre and of arterial flow were redoubled in IV degree hemorrhoid cases against the regular patients.

We are persuaded that the vascular factor is determinant for hemorrhoidal pathogene-

sis and that the prolapsing character is an effect of the volumetric increase with the relative encumbrance of the haemorrhoidal piles into the anal canal at the internal plexus level. Problems at evacuation impact all those factors: even the tone alteration at rest of the internal anal sphincter appears a consequence of vascular alteration.¹⁵

We, therefore, think that precise suture of the arterial branches detected with the Doppler technology, above the ano-rectal line and thus over the internal hemorrhoidal plexus (the technique is extensively described in many publications which we recommend to the reader),^{16, 17} may be the moment for patients when the initial pathogenic hemorrhoidal process is finally terminated. Rapid ultrasound verification of the suturing performed assures the result of treatment of the vascular factor.

The present study indicates that it is possible to obtain far more satisfying results in patients affected by II and III degree hemorrhoids with bleeding as the principal symptom. Indeed, the degree of satisfaction was very good, 85% with a trauma effectively reduced to a minimum (disappearance of all symptoms linked with the procedure in 88% after the third day, postoperatively); a return to normal daily activities was registered by seventh day after operation, in some 80% of cases.

However, the most meaningful datum, seemed the total absence of early or later complications, by contrast with other conventional procedure types (Longo and Milligan Morgan procedures): postoperative hemorrhoidal stenosis, damage to anal continence, postoperative pain, urinary retention, septic complications.¹⁸⁻²³

The anatomy of the rectal anal canal remains totally intact after the HAL Doppler procedure; any eventual future operation in this anatomic site will not find any scar deformation.

Nonetheless, the same procedure can be repeated in the future given the absence of surgical trauma, in the case of complete or partial failure of the operation.

It is interesting to notice that HAL Doppler procedure is performed with a circumfer-

ence manoeuvre into the rectal anal canal above the ano-rectal line not only at the level of the principal hemorrhoidal piles, which occupy those positions at hours 3, 7, 11, in the gynecological position, but also at the terminal vessels level, which can be detected in the interposed seats. Thus treatment of those sectors which are generally left as during an hemorrhoidectomy for the integrity of mucocutaneous bridge which may, however, cause relapse is also effected.

This technique was also performed successfully in some cases of relapse (4 cases of Milligan-Morgan); the patients complained of renewed bleeding after evacuation, due to congested hemorrhoidal piles. Significant improvement was rapidly obtained after the procedure.

In analysing the cases studied by our team, consistent with those described in the literature, it is clear that the eventual complications and relapses recorded in our study all appeared within the first six months of our follow-up. The results registered after this term, remained stable. That datum might assume a favorable predatory value if projected into a longer observation time.

Moreover, the absence of trauma during the operation and the almost total absence of complications, lead to possible treatment of patients with severe pathology types which are disabling. Hemorrhoidal problems render their quality of life worse, with painful local symptomatology or with anemia. One may consider the case of neuropathic patients, patients already incontinent due to prior surgical operation or trauma, patients with hepatic or hematological problems. The extant illness is, in these cases, an effective contraindication for the demolishing manoeuvres of surgical resection at the level of the rectal anal canal for excision of hemorrhoids, as the case of hemorrhoidectomy or stapled prolassectomy.

This reasoning may be extended, in general, to all bedridden patients.

Suture of the terminal branches of the upper hemorrhoidal artery blocks arterial flow to the internal hemorrhoidal plexus. Consequently HAL Doppler also interrupts development of the events which lead unre-

lently to the most advanced stages of hemorrhoidal illness. That is true and evident in patients with structural alterations characterized by augmented calibre and flow which is also visible in severe stages.

Eventually, when a group of at risk patients is recognized by simple transperineal ultrasound study (as demonstrated by Aigner), our team considers treatment with the HAL Doppler technique proper and suitable for those patients, since there is absence of surgical trauma and total absence of major complications. This HAL Doppler treatment not only assumes therapeutic significance but it also becomes genuine prophylaxis against the more advanced stages of the illness. The question of hemorrhoidal prolapse is differently correcting the prolapse, especially in III advanced degree or IV degree cases; the verification effected by our team indicates that hemorrhoidal prolapse only partially benefits from arterial ligation and only in the initial postoperative period, whence it reappears albeit with minor improvement in the symptoms.

Conclusions

The results of our study definitely appeared coherent with the data reported in the literature.

The HAL Doppler technique is safe and easy to perform; in our opinion, it is a first choice treatment in the therapy of II and III degree hemorrhoids characterised by bleeding. Indeed, it surpasses the surgical alternatives (hemorrhoidectomy or prolassectomy) with reference to operative trauma, complications and postoperative comfort, obtaining satisfying results.

Moreover, we believe that it is important to extend the indication for this technique, especially due to its low invasiveness, even to patients with neurological, hepatic and hematological problems, who are often excluded from conventional treatments due to the high risk of complications.

Low discomfort during the operation and the absence of complications justify the use of HAL Doppler also in patients affected by

the most precocious degree of haemorrhoidal illness. With this technique both a therapeutic procedure and prophylaxis of the most advanced degree of hemorrhoidal illness may be performed at the same time.

Riassunto

Legatura Doppler-guidata delle arterie emorroidarie (DG-HAL): un trattamento sicuro del II-III grado emorroidario per tutti i pazienti. Potrebbe potenzialmente avere anche un ruolo nella profilassi?

Obiettivo. La legatura Doppler-guidata delle arterie emorroidarie (*hemorrhoidal artery ligation*, HAL Doppler) rappresenta un trattamento innovativo per la patologia emorroidaria ed è principalmente utilizzata per le emorroidi di II e III grado associate a sanguinamento. Questa tecnica mira alla dearterializzazione del plesso emorroidario interno mediante la legatura dei rami terminali dell'arteria rettale superiore utilizzando uno speciale proctoscopio ad ultrasuoni. Tale procedura è eseguita interamente al di sopra della linea pettinata e pertanto non provoca dolore. Scopo di questo studio è valutare la sicurezza, l'efficacia e la bassa invasività di questa tecnica nel trattamento delle emorroidi di II-III grado.

Metodi. Gli autori hanno trattato 148 pazienti, da maggio 2002 a dicembre 2007, affetti principalmente da emorroidi di II-III grado, caratterizzate da sanguinamento e dolore all'evacuazione. Questi pazienti sono stati inclusi in uno studio osservazionale retrospettivo; tale studio ha riguardato 128 pazienti pari all'86% dei casi trattati. Il follow-up varia da 5 a 72 mesi con un tempo medio di osservazione di 36,5 mesi.

Risultati. È stato registrato un successo del 90% nei pazienti affetti da emorroidi di II-III grado con assenza di complicazioni maggiori (emorragia, incontinenza, stenosi, perforazione, sepsi).

Conclusioni. Gli autori indicano, come dimostrato in letteratura, un ruolo efficace, sicuro e poco invasivo dell'HAL Doppler nel trattamento delle emorroidi di II-III grado e ne sottolineano un opportuno impiego nei pazienti affetti da patologia associate per le quali è controindicato il trattamento chirurgico standard. Infine, gli autori ipotizzano nelle emorroidi di basso grado un ruolo, per HAL Doppler, oltre che terapeutico, anche profilattico, dei gradi più avanzati di malattia.

Parole chiavi: HAL Doppler - Emorroidi - Emorragia - Fattore vascolare.

References

1. Ripetti V, Caricato M, Arullani A. Rectal perforation, retroperitoneum, and pneumomediastinum after stapling procedure for prolapsed hemorrhoids:

- report of a case and subsequent considerations. *Dis Colon Rectum* 2002;45:268-70.
2. Wong LY, Jiang JK, Chang SC, Lin JK. Rectal perforation: a life-threatening complication of stapled hemorrhoidectomy: report of a case. *Dis Colon Rectum* 2003;46:116-7.
 3. Cotton MH. Pelvic sepsis after stapled hemorrhoidectomy. *J Am Coll Surg* 2005;200:983; author reply 983.
 4. Morinaga K, Hasuda K, Ikeda T. A novel therapy for internal hemorrhoids: ligation of the hemorrhoidal artery with a newly devised instrument (Moricorn) in conjunction with a Doppler flowmeter. *Am J Gastroenterol* 1995;90:610-3.
 5. Sohn N, Aronoff JS, Cohen FS, Weinstein MA. Transanal hemorrhoidal dearterialization is an alternative to operative hemorrhoidectomy. *Am J Surg* 2001;182:515-9.
 6. Arnold S, Antonietti E, Rollinger G, Scheyer M. Doppler ultrasound assisted hemorrhoid artery ligation. A new therapy in symptomatic haemorrhoids. *Chirurg* 2002;73:269-73.
 7. Shelygin IuA, Titov Alu, Veselov VV, Kanametov MKh. Results of ligation of distal branches of the upper rectal artery in chronic hemorrhoid with the assistance of Doppler ultrasonography. *Khirurgiia (Mosk)* 2003;(1):39-44.
 8. Scheyer M, Antonietti E, Rollinger G, Mall H, Arnold S. Doppler-guided hemorrhoidal artery ligation. *Am J Surg* 2006;191:89-93.
 9. Greenberg R, Karin E, Avital S, Skornick Y, Werbin N. First 100 cases with Doppler-guided hemorrhoidal artery ligation. *Dis Colon Rectum* 2006;49:485-9.
 10. Bursics A, Morvay K, Kupcsulik P, Flautner L. Comparison of early and 1-year follow-up results of conventional hemorrhoidectomy and hemorrhoid artery ligation: a randomized study. *Int J Colorectal Dis* 2004;19:176-80.
 11. Thomson WH. The nature of haemorrhoids. *Br J Surg* 1975;62:542-52.
 12. Haas PA, Fox TA Jr, Haas GP. The pathogenesis of hemorrhoids. *Dis Colon Rectum* 1984;27:442-50.
 13. Aigner F, Bodner G, Conrad F, Mbaka G, Kreczy A, Fritsch H. The superior rectal artery and its branching pattern with regard to its clinical influence on ligation techniques for internal hemorrhoids. *Am J Surg* 2004;187:102-8.
 14. Aigner F, Bodner G, Gruber H, Conrad F, Fritsch H, Margreiter R *et al*. The vascular nature of hemorrhoids. *J Gastrointest Surg* 2006;10:1044-50.
 15. Chauhan A, Thomas S, Bishnoi PK, Hadke NS. Randomized controlled trial to assess the role of raised anal pressures in the pathogenesis of symptomatic early hemorrhoids. *Dig Surg* 2007;24:28-32.
 16. Jongen J, Peleikis HG. Doppler-guided hemorrhoidal artery ligation: an alternative to hemorrhoidectomy. *Dis Colon Rectum* 2006;49:1082-3; author reply 1083.
 17. Felice G, Privitera A, Ellul E, Klaumann M. Doppler-guided hemorrhoidal artery ligation: an alternative to hemorrhoidectomy. *Dis Colon Rectum* 2005;48:2090-3.
 18. Fleshman J. Advanced technology in the management of hemorrhoids: stapling, laser, harmonic scalpel and ligasure. *J Gastrointest Surg* 2002;6:299-301.
 19. Ng KH, Ho KS, Ooi BS, Tang CL, Eu KW. Experience of 3 711 stapled hemorrhoidectomy operations. *Br J Surg* 2006;93:226-30.
 20. Holzheimer RG. Hemorrhoidectomy: indications and risks. *Eur J Med Res* 2004;9:18-36.
 21. Lindsay I, Jones O, Smilgin Humphreys, Cunningham C, Mortensen N. Patterns of fecal incontinence after anal surgery. *Disease Colon Rectum* 2004;47:1643-9.
 22. Blouhos K, Vasiliadis K, Tsalis K, Botsios D, Vrakas X. Uncontrollable intra-abdominal bleeding necessitating low anterior resection of the rectum after stapled hemorrhoidopexy: report of a case. *Surg Today* 2007;37:254-7.
 23. Ramcharan KS, Hunt TM. Anal stenosis after LigaSure hemorrhoidectomy. *Dis Colon Rectum* 2005;48:1670-1; author reply 1671.