

ORIGINAL ARTICLE

Medicine Science 2022;11(3):963-7

Superselective vesical artery embolisation of bleeding associated with bladder cancer

Alperen Kayali¹, Ibrahim Bariscan Soydan¹, Ayca Seyfettin², Sadik Gorur¹¹Hatay Mustafa Kemal University, Faculty of Medicine, Department of Radiology, Hatay, Turkey²Osmaniye State Hospital, Department of Radiology, Osmaniye, Turkey

Received 29 January 2022; Accepted 30 March 2022

Available online 19.06.2022 with doi: 10.5455/medscience.2022.01.022

Copyright@Author(s) - Available online at www.medicinescience.org

Content of this journal is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License.



Abstract

Superselective vesical artery embolization is used in the control of bleeding due to bladder cancer. However, there are few studies with a small number of patients. The current study aimed to investigate the efficacy, complications, and short-mid-term results of super-selective transarterial embolization in the treatment of persistent hematuria associated with bladder cancer. A retrospective examination was made of 13 patients with bladder cancer-related persistent hematuria who were applied with selective vesical artery embolization in the interventional radiology unit. The patients were evaluated in terms of the success of the treatment, the patients' need for additional interventional procedures, and the complications related to the procedure. Superselective superior vesical artery embolization was applied to a total of 13 patients with a mean age of 78.85±11.76 years and a median follow-up of 181 days. The time without bleeding was determined as a median of 159 days (min: 15, max:1410 days). The short-term clinical success was calculated as 84.6%. In the long-term follow-up of the patients in this study, the clinical success was determined to be 76.9% and no major complications were observed in any patient. Superselective embolization of vesical arteries is an effective and reliable treatment method for bladder cancer-related bleeding with high clinical success rates and low complication rates.

Keywords: Bladder cancer, angiography, embolization, vesical artery

Introduction

Although there are variations in the frequency of bladder cancer according to localization, it can be counted among the ten leading cancers [1,2]. Bladder cancer often causes recurrent persistent hematuria [3]. Bladder irrigation and hydrodistension are the primary conventional methods used for persistent hematuria originating from the bladder. When treatment is not possible with conventional methods, the systemic procedures traditionally applied include cystectomy, urinary diversion, and internal iliac artery ligation [4].

Surgical treatment is the gold standard in the treatment of this disease, but as stated in several guidelines, there is no curative treatment method for bladder cancers that cannot be resected, and mortality rates are extremely high [5]. Even if the stage is suitable

for surgical treatment, this may not be possible in some patients because of comorbidities such as advanced age. In such patients, embolization with angiography can be used as a minimally invasive method in the control of hematuria [6].

Endovascular embolization of internal iliac arteries has been used for many years in the treatment of hematuria. Currently, super-selective embolization from the level of the vesical artery is preferred to reduce the risk of embolization outside the target. However, patient numbers are low in studies related to super-selective embolization, and data are restricted to the efficacy and reliability of the method [6].

The current study aimed to investigate the efficacy, complications, and short-mid-term results of super-selective transarterial embolization in the treatment of persistent hematuria associated with bladder cancer.

Materials and Methods

This study was approved by Hatay Mustafa Kemal University Ethics Committee (Date: 17/06/2021 No: 15).

*Corresponding Author: Alperen Kayali, Hatay Mustafa Kemal University, Faculty of Medicine, Department of Radiology, Hatay, Turkey
E-mail: alperenkayali@gmail.com

After ethical approval, a retrospective examination was made of 13 patients with bladder cancer-related persistent hematuria who were applied with super-selective vesical artery embolization in the interventional radiology unit between 2016 and 2020. Superselective vesical artery embolization was performed on patients who had not responded to hematuria palliation such as transurethral resection under cystoscopy guidance and repeated bladder irrigation. Patients with contrast allergy, arterial access problems (occlusion of the common iliac arteries), and patients who did not accept the procedure were not included in the study.

In all the patients, images were obtained of both internal iliac arteries and branches with the aid of a 5F pigtail catheter (Imager II; Boston Scientific, Natick, MA, USA) from the abdominal aorta entered via the femoral route. Then, images were obtained with 5F diagnostic (Simon 1, Simon 2, Kobra 2, Bern) catheters (Imager II; Boston Scientific, Natick, MA, USA) entered selectively to the internal iliac arteries contralateral to the entry site. To prevent embolization outside the target in patients with vesical artery origin anomaly and in those where the anatomy could not be determined because of superpositioning, arterial perfusion maps were created using cone-beam computed tomography. Entering the superior vesical artery with the help of a 2.2F microcatheter (Carnelian, Tokai Medical Products, Aichi, Japan), embolization was provided with microspheres (Embozene microspheres; CeloNova BioSciences, Newnan, GA, USA) 250-400 microns in size (Figure 1). The same procedure was applied to the opposite side. However, as superior vesical artery filling could not be observed on the images obtained at the level of the other internal iliac artery after embolization of the first superior vesical artery in some patients or because the mass could be lateralized, the procedure was terminated by unilateral embolization of the superior vesical artery in these patients.

To evaluate the success of the treatment, the laboratory and clinical

follow-up data after the procedure were examined. The need for an additional interventional procedure was investigated with the reason for bleeding in hematuria recurring during follow-up. The patients were also evaluated in respect of procedure-related complications.

Results

Superselective superior vesical artery embolisation was applied to a total of 13 patients, comprising 12 (92.3%) males and 1 (7.7%) female with a mean age of 78.85 ± 11.76 years (51-91 years) and median follow-up of 181 days (15-1410 days). The embolisation procedure was applied as unilateral to 6 (46.1%) patients and bilateral to 7 (53.8%) patients. The time without bleeding was determined as median 159 days (15-1410 days). Repeated bleeding within the first 30 days was observed in 2 (15.3%) patients. The short-term clinical success was calculated as 84.6%. Radical cystectomy was applied to these two patients, and both developed mortality in the early postoperative period because of comorbidities. During the follow-up period of longer than one month of 11 patients, no bleeding developed in 6 patients. Of the 5 patients with recurrent bleeding, surgery was performed in one case and this patient was exitus in the first week postoperatively because of comorbidities. No additional interventional procedure was required in the other 4 patients with bleeding and with the conventional methods applied to stop the bleeding, only minimal hematuria was observed.

In the long-term follow-up of the patients in this study, the clinical success was determined to be 76.9%. When the whole sample was evaluated, bleeding requiring an additional intervention was observed in 3 (23%) of 13 patients. Postembolisation syndrome, which started immediately after the procedure and progressed with pain and subfebrile fever within a few days, was observed in 3/13 (23%) patients, and no major complications were observed in any patient. The patient data are shown in Table 1.

Table 1. Patient demographics and follow-up information

Age	Gender	Embolization	Time without bleeding	Surgery for bleeding	Death time	Follow up
66	F	Bilateral	185 days	No	243 days	243 days
51	M	Unilateral/left	15 days	Yes	15 days	15 days
90	M	Unilateral/left	33 days	No	33 days	33 days
86	M	Unilateral/left	92 days	No	live	394 days
74	M	Unilateral/right	64 days	No	97 days	97 days
79	M	Bilateral	61 days	Yes	61 days	61 days
83	M	Unilateral/left	No bleeding	No	live	1410 days
86	M	Unilateral/left	No bleeding	No	759 days	759 days
91	M	Bilateral	No bleeding	No	242 days	242 days
90	M	Bilateral	No bleeding	No	159 days	159 days
67	M	Bilateral	15 days	Yes	15 days	15 days
85	M	Bilateral	Nobleeding	No	live	181 days
77	M	Bilateral	No bleeding	No	live	213 days

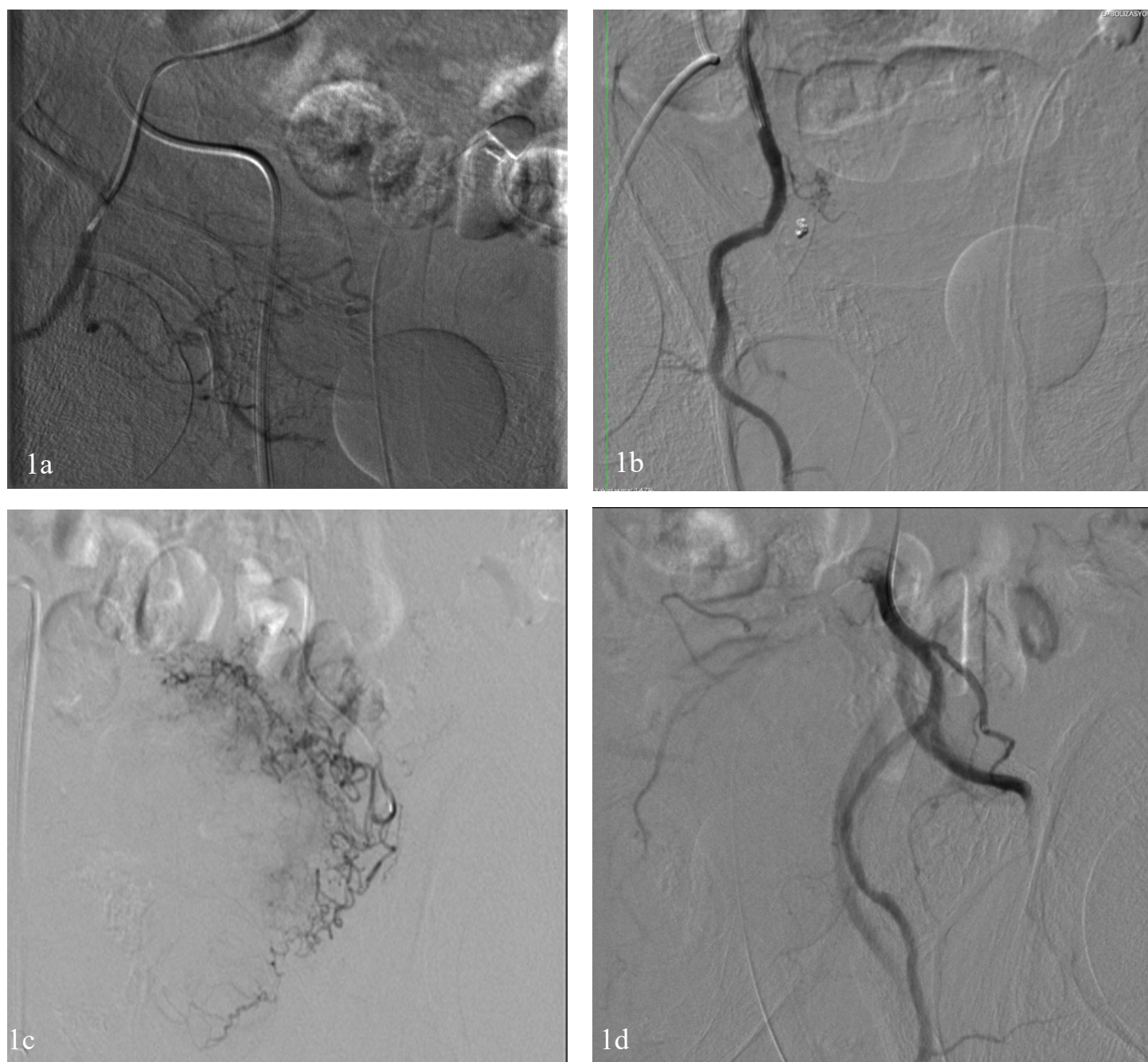


Figure 1. Right (a), left (b) vesical artery DSA images of the patient with hematuria due to bladder cancer were obtained. After super selective bilateral embolization, complete embolization of the right (c) and left (d) vesical arteries is achieved, and accordingly, contrast filling is not observed

Discussion

In our study, we aimed to investigate the effectiveness of superselective vesical artery embolization in the treatment of bleeding due to bladder cancer. We achieved high clinical success in short and long-term follow-ups with superselective vesical artery embolization in the patients with bleeding due to bladder cancer that could not be treated by conventional methods (84.6%, 76.9%, respectively). Major complication or procedure-related mortality was observed in any of our patients.

Bladder cancer is often a reason for recurrent persistent hematuria [3]. Great difficulties emerge in the follow up of persistent hematuria making it a potentially life-threatening event [7].

Surgical treatment is the most important treatment method in bladder cancer, contributing greatly to patient survival. However, the invasion of surrounding structures by some bladder cancers makes surgical treatment impossible. Even if the disease stage is suitable for surgical treatment, it may not always be possible because of other factors such as advanced age. In patients aged over 80 years in particular, high mortality rates are seen after radical cystectomy [8]. Age has been reported to be the most important factor determining mortality following radical cystectomy [9]. In patients where surgery is not possible, methods can be attempted such as bladder irrigation or the intravesical application of some clotting agents or formalin, which can be administered under local or short-term anesthesia [10]. However, when hematuria

continues, multiple blood transfusions and repeated isctalizations increase the risks of morbidity and mortality [4]. The efficacy of conservative methods in stopping bleeding can vary between 50% and 100% [11]. Although radiotherapy is one of the methods that can be used in the treatment of bladder cancer-related hematuria, it is not suitable for patients with acute bleeding because of the need for multiple sessions on repeated days [12].

The use of transarterial embolisation in the treatment of bladder cancer-related hematuria starts with the embolisation of internal iliac arteries. Superselective embolisation of vesical arteries is currently preferred for more effective treatment and to reduce the risk of embolisation outside the target. Superselective embolisation of vesical arteries is a minimally invasive procedure which allows control of severe bleeding and reduces complications to a minimum [3]. As the superselective approach allows the use of more embolic agent, it has been predicted to be useful in preventing recurrent bleeding [12].

However, in previous studies related to superselective embolisation, patient numbers are low and data are restricted to the efficacy and reliability of the method [6]. Although there are no extensive series in recent literature about superselective vesical artery embolisation, it has been reported to be a method with high success rates and low complication rates [7, 13]. The short-term success rates following vesical artery embolisation for bladder cancer-related hematuria have been reported to be 92.6%-100% [7, 14, 15]. In the current study, the short-term clinical success rate of 84.6% was seen to be similar to findings in literature. This relatively lower rate of clinical success in the current study can be attributed to the fact that embolisation was not repeated in any patient with recurrent bleeding.

In a previous study of superselective vesical artery embolisation applied to bladder bleeding developing associated with pelvic malignancies, the rate of recurrent bleeding was found to be approximately 33% [12]. Although there are studies that have reported no difference between bilateral and unilateral vesical artery embolisation in respect of recurrent bleeding [7, 12], there are also publications which have suggested that the risk of recurrent bleeding is higher after unilateral embolisation [16, 17]. The broad collateral network of the internal iliac artery seems to be one of the most important reasons for recurrent bleeding after embolisation [12]. In the current study, bleeding which would require further intervention was determined at the rate of 23%.

Major complications are not generally expected after superselective vesical artery embolisation [7, 12]. Although rare, major complications may be seen such as bladder necrosis, and abdominal wall ischemia [18, 19]. The use of larger size particles and avoiding embolisation outside the target are thought to lower the complication rates of embolisation applied superselectively. No major complications were observed in any patient in the current study. However, postembolisation syndrome accompanied by pain and subfebrile fever which was spontaneously limited to a few days, was observed in 23% of the patients.

It can be seen that arterial mapping with CBCT has not been used much in studies related to superselective vesical artery embolisation [20]. In the current study, it was aimed to avoid embolisation outside the target with the use of arterial mapping

with CBCT in patients with vesical artery origin anomaly or where the arterial anatomy could not be clearly determined. No complications were observed related to embolisation outside the target in the current study patients. The CBCT procedure has the disadvantages of prolonged procedure time and greater radiation exposure [21]. Nevertheless, it can be considered to be of benefit, especially in the avoidance of embolisation outside the target.

Studies related to superselective embolisation of vesical arteries have generally included a low number of patients and there are no studies that have compared the embolising agents used. However, it is recommended to use embolising agents with non-absorbable particles [3].

Embolisation methods for bleeding control have become effective and reliable treatment methods in current practice. Embolisation treatment can be applied to patients with a low performance score or to those who would not be able to undergo general anaesthesia. Thus, it is a helpful procedure in eliminating the need for emergency surgery for bleeding in this patient group [20].

Limitations of this study are the retrospective design and the relatively low number of patients.

Conclusion

In conclusion, when the results obtained are evaluated together with other findings in the literature, it can be concluded that superselective embolisation of vesical arteries is an effective and reliable treatment method for bladder cancer-related bleeding with high clinical success rates and low complication rates.

Conflict of interests

The authors declare that there is no conflict of interest in the study.

Financial Disclosure

The authors declare that they have received no financial support for the study.

Ethical approval

This study was approved by Hatay Mustafa Kemal University Ethics Committee (Date: 17/06/2021 No: 15).

References

1. Bray F, Ferlay J, Soerjomataram I, et al. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J. Clin.* 2018;68:394–424.
2. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2020. *CA Cancer J Clin.* 2020;70:7-30.
3. Pozzi Mucelli F, Pozzi Mucelli RA, Marrocchio C, et al. Endovascular Interventional Radiology of the Urogenital Tract. *Med (Kaunas).* 2021;57:278.
4. Choong SK, Walkden M, Kirby R. The management of intractable haematuria. *BJU Int.* 2000;86:951-9.
5. Omorphos NP, Piedad JCP, Vasdev N. Guideline of guidelines: Muscle-invasive bladder cancer. *Turk J Urol.* 2021;47:71-8.
6. Loffroy R, Pottecher P, Cherblanc V, et al. Current role of transcatheter arterial embolization for bladder and prostate hemorrhage. *Diagn Interv Imaging.* 2014;95:1027-34.
7. Delgal A, Cercueil JP, Koutlidis N, et al. Outcome of transcatheter arterial embolization for bladder and prostate hemorrhage. *J Urol.* 2010;183:1947-53.
8. Haden TD, Prunty MC, Jones AB, et al. Perioperative outcomes in

- septuagenarians and octogenarians undergoing radical cystectomy for bladder cancer-Do outcomes differ? *Eur Urol Focus* 2018;4:895-9.
9. Lughezzani G, Sun M, Shariat SF, et al. A population-based competing-risks analysis of the survival of patients treated with radical cystectomy for bladder cancer. *Cancer* 2011;117:103-9.
 10. Abt D, Bywater M, Engeler DS, Schmid HP. Therapeutic options for intractable hematuria in advanced bladder cancer. *Int J Urol*. 2013;20:651-60.
 11. Ghahestani SM, Shakhssalim N. Palliative treatment of intractable hematuria in context of advanced bladder cancer: a systematic review. *Urol J*. 2009;6:149-56.
 12. Kim MS, Hong HP, Kang KA, et al. Superselective vesical artery embolization for intractable bladder hemorrhage related to pelvic malignancy. *Acta Radiol*. 2021;62:1229-37.
 13. Cho CL, Lai MH, So HS, et al. Superselective embolisation of bilateral superior vesical arteries for management of haemorrhagic cystitis. *Hong Kong Med J*. 2008;14:485-8.
 14. Prasad V, Sacks BA, Kraus S, Clouse ME. Embolotherapy for lower urinary tract hemorrhage. *J Vasc Interv Radiol*. 2009;20:965-70.
 15. De Berardinis E, Vicini P, Salvatori F, et al. Superselective embolization of bladder arteries in the treatment of intractable bladder haemorrhage. *Int J Urol*. 2005;12:503-5.
 16. Hald T and Mygind T. Control of life-threatening vesical hemorrhage by unilateral hypogastric artery muscle embolization. *J Urol*. 1974;112:60.
 17. Hietala SO: Urinary bladder necrosis following selective embolization of the internal iliac artery. *Acta Rad Diagn*. 1978;19:316.
 18. Tarkhanov A, Bartal G, Druzhin S, et al. Bladder wall and surrounding tissue necrosis following bilateral superselective embolization of internal iliac artery branches due to uncontrollable haematuria related to bladder tumor: case report. *CVIR Endovasc*. 2018;1:34.
 19. Tsitskari M, Spiliopoulos S, Konstantos C, et al. Long-term results of super-selective trans-catheter embolization of the vesical arteries for the treatment of intractable bladder haematuria. *CVIR Endovasc*. 2020;3:97.
 20. Mohan S, Kumar S, Dubey D, et al. Superselective vesical artery embolization in the management of intractable hematuria secondary to hemorrhagic cystitis. *World J Urol*. 2019;37:2175-82.
 21. Bürckenmeyer F, Diamantis I, Krieckenbauer T, et al. Prostatic artery embolization: Influence of cone-beam computed tomography on radiation exposure, procedure time, and contrast media use. *Cardiovasc Intervent Radiol*. 2021;44:1089-94.