

# Selective and super-selective angioembolisation for intractable haematuria of prostatic origin

V Prabha,<sup>1</sup> S Devaraju,<sup>1</sup> N Mulimani<sup>2</sup>

<sup>1</sup>Department of Urology, JN Medical College, KLE Academy of Higher Education and Research, India

<sup>2</sup>Department of Interventional Radiology, JN Medical College, KLE Academy of Higher Education and Research, India

Corresponding author, email: [sdevaraju24@gmail.com](mailto:sdevaraju24@gmail.com)

**Objective:** To assess the role and outcomes following selective and super-selective angioembolisation in the management of patients with intractable haematuria of prostatic origin.

**Materials and methods:** A retrospective analysis of data from 10 patients undergoing selective and super-selective angioembolisation for intractable haematuria of prostatic origin at our institution between January 2017 and January 2020. There were six patients of advanced carcinoma prostate, two patients of benign prostatic hyperplasia (with significant comorbidities) and two patients with bleeding following trans-urethral resection of the prostate. After initial stabilisation, the patients were subjected to selective and super-selective angioembolisation of bleeding vessels using the standard technique and mixture of PVA particles and Gel foam slurry as the embolising agent.

**Results:** Mean age of patients in the study was 73.9 years (range 65–82 years, SD  $\pm$  5.17). Eight patients had associated comorbidities. Mean haemoglobin and haematocrit values pre-procedure were 7.64 gm/dl and 28.7% respectively and post-procedure were 7.24 gm/dl and 27.4% respectively. The difference between these values was statistically insignificant ( $p$ -value 0.30 for haemoglobin and 0.44 for haematocrit). Two patients needed post-procedure blood transfusions. Mean follow-up was 16.3 months. No patient had immediate rebleeding (initial six months), but two patients with advanced carcinoma prostate had late rebleeding needing repeat non-selective embolisation. Complications were minor (Clavien Dindo Class I/II). Mean hospital stay was 5.7 days (range 4–7 days, SD  $\pm$  0.82).

**Conclusion:** Selective and super-selective angioembolisation can be employed safely and effectively in the management of intractable haematuria of prostatic origin with good short to midterm results.

**Keywords:** angioembolisation, haematuria, prostate, management

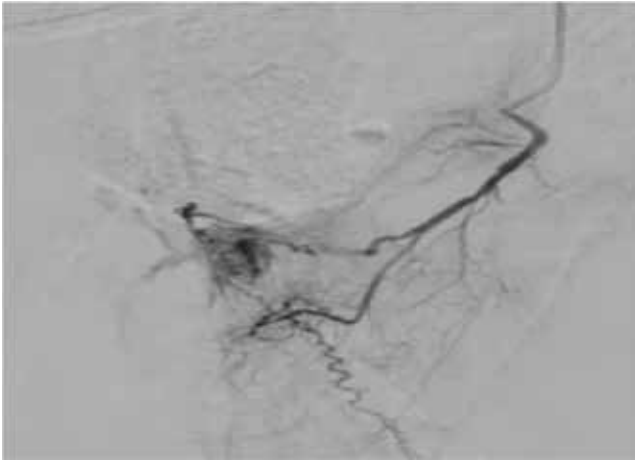
## Introduction

Significant haematuria of prostatic origin can occur because of a number of causes such as benign prostatic hyperplasia, carcinoma of the prostate (primary or after radiation) and following transurethral resection of the prostate.<sup>1</sup> Often, the bleeding can be managed by passing a wide bore 3-ways Foley catheter with balloon inflated and traction applied at the bladder neck or prostatic fossa and continuous bladder irrigation.<sup>2</sup> If this fails, cystoscopy and evacuation of bladder clot and electro-fulguration of the bleeding points is employed.<sup>3</sup> If bleeding continues despite these measures, a life-threatening situation may arise and will require open surgical exploration to pack the prostatic fossa and peri-prostatic space.<sup>4</sup> In patients with pre-existing comorbidities and risk factors, these repeated surgical procedures may carry a higher rate of morbidity and mortality.<sup>5</sup> Selective or super-selective angioembolisation of the bleeding vessels is minimally invasive and has been employed in such cases with good short and long-term control of the haematuria. We present our own institutional experience with the procedure in 10 patients.

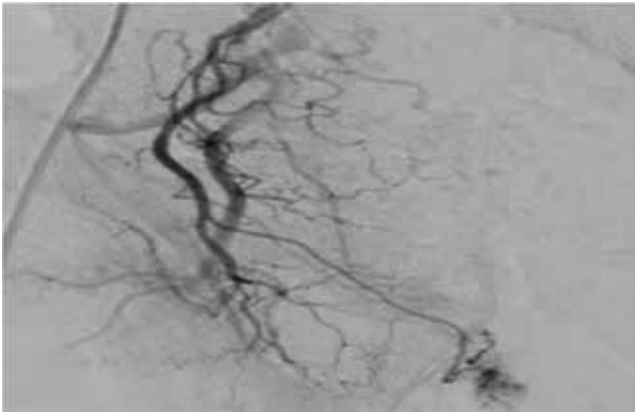
## Materials and methods

Retrospective analysis of the records of 10 patients undergoing selective angioembolisation for intractable haematuria of prostatic origin at our institution between January 2017 and January 2020 was done. All 10 patients had intractable haematuria defined as bleeding from the prostate not responding to irrigation and

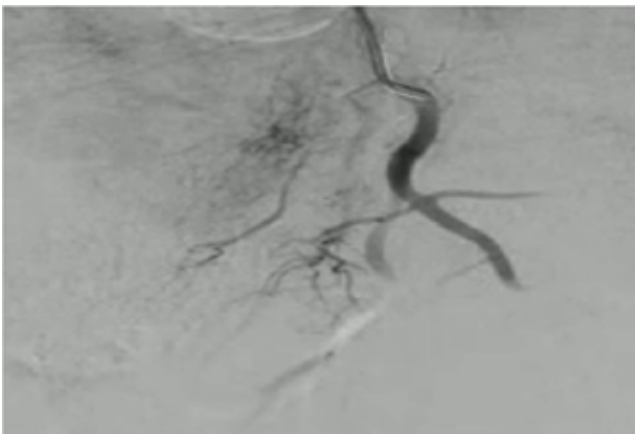
drainage of the bladder, transurethral fulguration and/or rate of blood loss exceeding replacement. The patients were stabilised and taken up for the procedure in the interventional radiology suite equipped with a digital subtraction angiography unit. One experienced interventional radiologist performed the procedure under local anaesthesia. A Foleys catheter to drain the bladder and prophylactic antibiotic (Injection Ceftriaxone, 1 g IV) were used in all patients. Percutaneous puncture using the Seldinger technique and catheterisation of the right common femoral artery was done using a 5Fr sheath. Initially, angiography of the iliac vessels was performed using a 5Fr Cobra (AngioDynamics, Inc., Queensbury, NY, USA) and Simmon's 1 catheter. The vascular anatomy of the pelvic vessels, especially the prostatic and vesical arteries was closely assessed. Wherever possible, the bleeding vessels identified by localised hyper-vascular blush or contrast extravasation (Figure 1 and Figure 2), were super-selectively catheterised using a 3Fr co-axial Progreat microcatheter (Terumo Corporation, Japan) and embolised with PVA particles (Boston Scientific Corporation, USA) Gelfoam slurry mixed with contrast medium (355–500  $\mu$ m PVA particles for the distal branches and 500–710  $\mu$ m for the larger proximal branches). If super-selective catheterisation was not possible, selective embolisation of the distal branches of anterior division of the internal iliac artery was carried out using the same agents. A repeat angiogram was done to confirm reduction in vascularity and/or absence of contrast extravasation (Figure 3). In those patients who had a rebleed after initial super-selective or selective embolisation, non-selective coil blockade (0.035-inch



**Figure 1:** Selective angiography of the left internal iliac vessels showing vascular blush from a bleeding prostatic arterial branch in a patient who had persistent bleeding after a TURP



**Figure 2:** Angiography of the pelvic vessels demonstrating increased vascularity and vascular blush in the distal branch of the right prostatic artery in a patient with carcinoma prostate



**Figure 3:** Post-selective embolisation image showing decreased vascularity in the distal branches of the anterior division of left internal iliac artery

steel coils of an appropriate size) of the internal iliac artery was employed to control bleeding (Figure 4 and Figure 5).

The patients in our series received appropriate antibiotics and other supportive measures as needed. They were discharged once all visible haematuria had stopped. Patients were followed up initially every 15 days in the first two months and then once a month for the next six months and every three months thereafter.



**Figure 4:** Angiogram of left iliac vessels in a patient with carcinoma prostate, who had a rebleed after initial selective embolisation; note diffuse hyper-vascularity of the pelvic vessels



**Figure 5:** Non-selective coil blockage of the internal iliac artery in the same patient as in Figure 4

## Results

During the period January 2017 to January 2020, 10 patients with intractable haemorrhage of prostatic origin underwent selective and super-selective embolisation of the bleeding vessels. There were six patients of locally advanced and/or metastatic carcinoma prostate, two patients of benign hyperplasia of the prostate (BPH), and two patients of post-transurethral resection of prostate (TURP) bleeding in this study. Mean age was 73.9 yrs (range 65–82 years, SD  $\pm$  5.17) (Table I). Mean haemoglobin and haematocrit values preop were 7.64 gm/dl and 28.7% respectively and postop were 7.24 gm/dl and 27.4% respectively. The difference between these values was statistically insignificant ( $p$ -value 0.30 for haemoglobin and 0.44 for haematocrit). This data, prostate volumes, serum prostate-specific antigen (PSA) levels and associated comorbidities in our cohort of patients, are presented in Table II. Post-procedure blood transfusions were needed in two patients (20%) with advanced carcinoma prostate. The mean hospital stay was 5.7 days (range 4–7 days, SD  $\pm$  0.82). Post-procedure complications were minor (Clavien Dindo I/II) and related to small haematoma at femoral puncture site (one patient), supra-pubic pain lasting for one to two

Table I: Study data

| Sl. no | Age (yrs) | Indication         | Site of embolisation       | Follow up | Late rebleeding | Post-procedure blood transfusion |
|--------|-----------|--------------------|----------------------------|-----------|-----------------|----------------------------------|
| 1.     | 65        | Post TURP          | Unilateral super-selective | 24 months | No              | No                               |
| 2.     | 80        | Carcinoma prostate | Bilateral selective        | 14 months | Ye              | <b>Yes</b>                       |
| 3.     | 76        | Carcinoma prostate | Bilateralselective         | 8 months  | No              | No                               |
| 4.     | 76        | Post TURP          | Unilateral super-selective | 18 months | No              | No                               |
| 5.     | 75        | Carcinoma prostate | Bilateral selective        | 6 months  | –               | No                               |
| 6.     | 70        | BPH                | Bilateral super-selective  | 30 months | No              | No                               |
| 7.     | 69        | Carcinoma prostate | Bilateral selective        | 12 months | No              | No                               |
| 8.     | 82        | Carcinoma prostate | Bilateral selective        | 10 months | Ye              | <b>Yes</b>                       |
| 9.     | 75        | BPH                | Bilateral super-selective  | 26 months | No              | No                               |
| 10.    | 76        | Carcinoma prostate | Bilateral selective        | 15 months | No              | No                               |

Table II: Patient demographics

| Patient no | Age         | Preop HB%   | Postop HB%  | Preop HCT%  | Postop HCT% | Prostate volume (cc) | PSA (ng.ml)     | Comorbidities                                        |
|------------|-------------|-------------|-------------|-------------|-------------|----------------------|-----------------|------------------------------------------------------|
| 1.         | 65          | 8.5         | 8           | 30          | 30          | 60                   | 2.1             | Ischaemic heart disease                              |
| 2.         | 80          | 6.5         | 6           | 26          | 24          | 94                   | 345             | Diabetes and hypertension                            |
| 3.         | 76          | 8.6         | 8           | 32          | 30          | 80                   | 152             | None                                                 |
| 4.         | 71          | 9           | 8           | 34          | 32          | 45                   | 1.8             | Hypertension and ischaemic heart disease             |
| 5.         | 75          | 7.6         | 7           | 24          | 24          | 70                   | 280             | COPD                                                 |
| 6.         | 70          | 8           | 7.8         | 30          | 27          | 65                   | 3               | Ischaemic heart disease                              |
| 7.         | 69          | 7           | 7           | 26          | 24          | 55                   | 89              | None                                                 |
| 8.         | 82          | 6.2         | 6           | 24          | 23          | 68                   | 726             | Diabetes and hypertension                            |
| 9.         | 75          | 7.8         | 7.6         | 32          | 34          | 100                  | 4               | Ischaemic heart disease, diabetes and hypothyroidism |
| 10.        | 76          | 7.2         | 7           | 29          | 26          | 58                   | 130             | Hypertension                                         |
| Mean ± SD  | 73.9 ± 5.17 | 7.64 ± 0.92 | 7.24 ± 0.78 | 28.7 ± 3.53 | 27.4 ± 3.86 | 69.5 ± 17.31         | 173.29 ± 229.05 |                                                      |

days after the procedure, which could be managed by analgesics (four patients) and fever (two patients – these patients were treated as for post-embolic syndrome). Maximum follow-up was for 26 months and the minimum follow-up was for six months. Mean follow-up was 16.30 months. During follow-up, two patients with advanced carcinoma prostate had late rebleeding seven and nine months after initial selective embolisation and they were managed with bilateral non-selective embolisation of the iliac arteries. None of the other patients had recurrence of haematuria during follow-up.

## Discussion

Significant haematuria from the prostate, primarily (from a disease process) or from iatrogenic causes, can sometimes be a challenge to manage. Bleeding from carcinoma prostate is known to be especially troublesome. The patients in this situation are elderly, frail and have advanced disease that precludes any major operative interventions to control haemorrhage. Occasionally, after a seemingly regular TURP, there may be a situation of persistent bleeding despite all conservative attempts to arrest it. Although embolisation of the internal iliac artery to control bleeding in the pelvis was described by Hald and Mygind way back in 1974,<sup>6</sup> it

was DeMeritt et al.<sup>7</sup> who first published a case report employing super-selective prostatic artery embolisation to control intractable haematuria in a patient with BPH. Since then, selective or super-selective embolisation has been used for effective and rapid control of bleeding from the prostate with minimum morbidity. Typically, the prostate has two arterial branches supplying it. These may arise as a common trunk (60% of pelvic sides) or as separate branches (40% of pelvic sides). The anterolateral branch supplies the central portion of the prostate and posterolateral branch, the peripheral part of the prostate. The prostatic arteries usually originate from the internal pudendal artery (30–40%), but highly variable sites of origin between individuals and also in the same person on the right and left sides have been noticed. These vessels have a diameter of 1–2 mm and, unlike the uterine arteries, have no characteristic anatomy on imaging. There may be abnormal anastomosis of the prostatic arteries and the surrounding blood vessels, especially in advanced malignancies in up to 60% of cases.<sup>8,9</sup> Despite all these anatomic challenges, the technical success rate of selective and super-selective angioembolisation of these vessels in most of the reported series is close to, or more than 90%.<sup>10</sup> In our own series of 10 patients, the technical success rate was 100%.

In many previous studies, it was found that the rebleeding rates were higher after unilateral embolisation in malignancies due to probable neovascularisation changes of the internal iliac artery from the surrounding major vessels like the mesenteric, external iliac, contralateral internal iliac and femoral arteries.<sup>11</sup> Hence, the six patients with carcinoma prostate underwent selective embolisation of the distal branches of the internal iliac arteries bilaterally. Despite this, two patients (20%) with carcinoma prostate had late rebleeding about seven and nine months after the initial treatment. They were subjected to repeat bilateral non-selective angioembolisation of the internal iliac arteries and had no further episodes of gross haematuria requiring hospitalisation till the last follow-up. It was possible to identify the specific bleeding arteries in the two cases of post-TURP bleeding and super-selectively embolise them. The two patients with benign prostatic hyperplasia in the study were on antiplatelet medication after recent PTCA for severe ischaemic heart disease. They had been previously evaluated for bothersome LUTS and were on combined alpha-blocker (Tamsulosin/Silodosin) and anti-androgen (Finasteride) therapy. These patients were unfit for any surgical intervention in view of their poor cardiac status and so underwent bilateral super-selective angioembolisation. These patients also had improvement in their IPSS scores and peak flow rates on follow-up. Prostate volume was reduced in both patients after the procedure. The recent Society of Interventional Radiology (SIR) position statement on prostate artery embolisation for the treatment of benign disease of the prostate states that it is a novel therapy that appears safe and efficacious based on short-term follow-up. They note that patient satisfaction is high and repeat interventions are low.<sup>12</sup> In all the cases, gross haematuria reduced significantly after the procedure in a mean of two days (range 1–4 days), giving us an immediate clinical success rate of 100%. Two patients with carcinoma of the prostate, needed packed red blood cell transfusions. Earlier studies, which used non-selective embolisation protocols, had a higher rate of more serious complications (up to 68.5%) related to the procedure, such as bladder necrosis, buttock pain, gluteal muscle paresis, skin necrosis and Brown-Sequard's syndrome.<sup>13–16</sup> The recent series (after 2005) employing selective or super-selective embolisation, have recorded low rates of complication, mainly minor, in the range of 10–15%. Since the primary procedure in our study too was selective or super-selective, complications were minor (Clavien-Dindo type I or II). One of the patients who had non-selective embolisation after a re-bleed had persistent buttock pain, requiring opioid analgesics. The patients were discharged once visible haematuria had subsided. The patients had their catheters removed and sent home once they were voiding urine without any difficulties. One patient with carcinoma prostate had bilateral nephrostomies and another, a DJ stent on the right side and a per-urethral catheter at discharge, as the disease was locally advanced and obstructing the right ureterovesical junction and bladder outlet.

## Conclusion

Selective and super-selective angioembolisation can be lifesaving in intractable haematuria of prostatic origin in benign conditions and effective palliation in malignancies. Our early experience with this small subset of patients indicates that the procedure

can be safely performed with good short to midterm results and minimum morbidity. Wherever facilities exist, this minimally invasive procedure should be employed ahead of any major or invasive surgical attempt to control persistent bleeding from the prostate.

## Limitations of the study

- Small sample size.
- Lack of long-term follow-up.
- Procedure requires the availability of an experienced interventional radiologist and a well-equipped radiology suite.

## Main points

- Super-selective and selective angioembolisation to manage intractable haematuria of the prostatic origin is technically feasible, safe and efficient.
- It provides adequate control over repeated episodes of gross haematuria of prostatic origin in the short to mid-term, especially in non-cancer-related causes.
- Reduces morbidity, hospital stay and need for blood transfusions in these cases.
- Where facilities and expertise exist, this procedure can be considered over the more invasive surgical options to control bleeding from the prostate.
- It is especially beneficial in the elderly population with multiple comorbidities.

## Conflict of interest

The authors declare no conflict of interest.

## Ethical approval

Ethical approval was obtained from the Kles Kidney Foundation Institutional Ethics Committee (KLESKF/IEC/2020/24).

## ORCID

V Prabha  <https://orcid.org/0000-0002-5340-5293>

S Devaraju  <https://orcid.org/0000-0002-3099-3109>

N Mulimani  <https://orcid.org/0000-0001-8424-4675>

## References

1. Michel F, Dubrulle T, Cercueil JP, et al. Arterial embolization for massive hematuria following transurethral prostatectomy. *J Urol.* 2002;168:2550-1. [https://doi.org/10.1016/S0022-5347\(05\)64200-0](https://doi.org/10.1016/S0022-5347(05)64200-0).
2. Nerli RB, Kadeli V, Mulimani N, Ghagane SC. Endovascular management in a case of recurrent bleed following transurethral resection of the prostate. *Arab J Intervent Radiol.* 2018;2:33-35. [https://doi.org/10.4103/AJIR.AJIR\\_28\\_17](https://doi.org/10.4103/AJIR.AJIR_28_17).
3. Barbieri A, Simonazzi M, Marcato C, et al. Massive hematuria after transurethral resection of the prostate: management by intra-arterial embolization. *Urologia internationalis.* 2002;69(4):318-20. <https://doi.org/10.1159/000066115>.
4. Rastinehad AR, Caplin DM, Ost MC, et al. Selective arterial prostatic embolization (SAPE) for refractory hematuria of prostatic origin. *Urology.* 2008;71:181-4. <https://doi.org/10.1016/j.urology.2007.09.012>.
5. Chen JW, Shin JH, Tsao TF, et al. Prostatic arterial embolization for control of hematuria in patients with advanced prostate cancer. *J Vasc Interv Radiol.* 2017;28(2):295-301. <https://doi.org/10.1016/j.jvir.2016.10.010>.
6. Hald T, Mygind T. Control of life-threatening vesical hemorrhage by unilateral hypogastric artery muscle embolization. *J Urol.* 1974;112:60-63. [https://doi.org/10.1016/S0022-5347\(17\)59642-1](https://doi.org/10.1016/S0022-5347(17)59642-1).
7. DeMeritt JS, Elmasri FF, Esposito MP, Rosenberg GS. Relief of benign prostatic hyperplasia-related bladder outlet obstruction after transarterial polyvinyl alcohol prostate embolization. *J Vasc Interv Radiol.* 2000;11:767-70. [https://doi.org/10.1016/S1051-0443\(07\)61638-8](https://doi.org/10.1016/S1051-0443(07)61638-8).
8. Bilhim T, Tinto HR, Fernandes L, Pisco JM. Radiological anatomy of prostatic arteries. *Tech Vasc Interv Radiol.* 2012;15:276-85. <https://doi.org/10.1053/j.tvir.2012.09.006>.

9. Bihim T, Pisco JM, Rio Tinto H, et al. Prostatic arterial supply: anatomic and imaging findings relevant for selective arterial embolization. *J Vasc Interv Radiol.* 2012;23:1403-15. <https://doi.org/10.1016/j.jvir.2012.07.028>.
10. Appleton DS, Sibley GN, Doyle PT. Internal iliac artery embolisation for the control of severe bladder and prostate haemorrhage. *Br J Urol.* 1988;61:45-47. <https://doi.org/10.1111/j.1464-410X.1988.tb09160.x>.
11. Liguori G, Amodeo A, Mucelli FP, et al. Intractable haematuria: long-term results after selective embolization of the internal iliac arteries. *BJU Int.* 2010;106:500-3. <https://doi.org/10.1111/j.1464-410X.2009.09192.x>.
12. McWilliams JP, Kuo MD, Rose SC, et al. Society of Interventional Radiology Statement: Prostate artery embolization for treatment of benign disease of the prostate. *J Vasc Interv Radiol.* 2014;25:1349-51. <https://doi.org/10.1016/j.jvir.2014.05.005>.
13. Nabi G, Sheikh N, Greene D, Marsh R. Therapeutic transcatheter arterial embolization in the management of intractable haemorrhage from pelvic urological malignancies: preliminary experience and long-term follow-up. *BJU Int.* 2003;92:245-7. <https://doi.org/10.1046/j.1464-410X.2003.04328.x>.
14. Hietala SO. Urinary bladder necrosis following selective embolization of the internal iliac artery. *Acta Rad Diagn.* 1978;172:337-9.
15. Carmignani G, Belgrano E, Puppo P, et al. Transcatheter embolization of the hypogastric arteries in cases of bladder hemorrhage from advanced pelvic cancers: follow up in 9 cases. *J Urol.* 1980;124:196-200. [https://doi.org/10.1016/S0022-5347\(17\)55371-9](https://doi.org/10.1016/S0022-5347(17)55371-9).
16. Pisco JM, Martins JM, Correia MG. Internal iliac artery embolization to control hemorrhage from pelvic neoplasms. *Radiology.* 1989;172:337-9. <https://doi.org/10.1148/radiology.172.2.2748811>.