# Penile Scintigraphy for Priapism in Sickle Cell Disease

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Penile scintigraphy with [$^{99m}$Tc]pertechnetate/$^{99m}$Tc-RBCs was performed in patients with sickle cell disease patients who had priapism to assess the role of this imaging procedure in directing the clinical management of these patients. **Methods:** Fifteen studies were performed in 13 patients who were treated according to a protocol not dependent on the imaging results. The scintigraphic findings of penile vascular perfusion (stagnant or nonstagnant patterns) were collated retrospectively with the form of treatment needed for relief of the condition. **Results:** Four of five patients with the nonstagnant perfusion pattern responded to analgesics and intravenous hydration. Four of eight patients with the stagnant pattern did not require any aggressive interventions such as corporeal aspiration/irrigation, intracorporeal epinephrine or glans-cavernosa shunt. **Conclusion:** Whereas the nonstagnant scintigraphic finding appeared to be a favorable indicator for conservative treatment, the stagnant finding was apparently noncontributory. In addition, no correlation was found between these two types of scintigraphic patterns and the subsequent sexual potency of these patients.

**Key Words:** priapism; sickle cell disease; technetium-99m-pertechnetate; technetium-99m-RBCs

**J Nucl Med 1995; 36:1404–1407**

Scintigraphic imaging with in vivo labeled $^{99m}$Tc-RBCs or with [$^{99m}$Tc]pertechnetate has been utilized for evaluation of priapism (*1,2*). Hashmat et al. (*2*) performed scintigraphic studies on patients with priapism and found that patients with high-flow (tracer activity seen in the corpora cavernosa and corpus spongiosum) can be treated conservatively while those with low-flow (lack of tracer activity in the corpora cavernosa with or without activity in the corpus spongiosum) should be evaluated for aggressive therapy in conjunction with penile blood gas measurement. Due to the infrequent use of this imaging procedure, sufficient clinical appraisal of its application is lacking. We retrospectively analyzed the data obtained in our patients to evaluate the efficacy of this procedure in directing the management of priapism in sickle cell patients. Whether scintigraphy might be of value in predicting subsequent sexual potency was also assessed through clinical follow-up.

Received Apr. 25, 1994; revision accepted Oct. 17, 1994.

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## MATERIALS AND METHODS

### Patients

Thirteen patients (5 men, 8 boys; aged 5–38 yr) with sickle cell disease were studied. The clinical details of seven of the eight pediatric patients have been described elsewhere (*6*).

### Priapism Management

The general approach to management of priapism in our patients included: hospital admission with intravenous fluid hydration and analgesics for episodes lasting more than 3 hr; partial or reconstituted packed-cell exchange transfusions for those who failed to respond after 24–48 hr; intracorporeal blood gas with corporeal aspiration/irrigation and intracorporeal injection of epinephrine if priapism persisted after transfusion; glanscavernosa shunt (Winter procedure (*3*)) if the problem still persisted.

Except in one patient who had reduced but persistent priapism 2 wk after Winter shunting, all penile scintigraphies were performed early following admission while the patients were receiving analgesics and intravenous hydration. The scintigraphic findings were not assigned a decisive role in the selection of a treatment protocol.

Scintigraphy was performed after intravenous injection of [$^{99m}$Tc]pertechnetate with or without prior administration of stannous pyrophosphate for in vivo labeling of RBCs (*4*). For adults, the administered dose was 555–740 MBq (15–20 mCi). The amount given to the pediatric patients was adjusted according to body weight (*5*). Anterior view images were obtained with the patient in the supine position. The penis was taped upwards over the pubic region with a triple layer of lead apron placed beneath it to shield underlying body background activity. Continuous data acquisition was made for 30 min postinjection and images were grouped in 5-min frames.

Following the description of Hashmat et al. (*2*), the studies were interpreted as high-flow if activity appeared in the corpora cavernosa as well as the corpus spongiosum within 30 min of tracer administration (Fig. 1). Otherwise, a designation of low-flow was made (Fig. 2). Interpretation and review of the studies were performed by three experienced nuclear medicine physicians.

The scintigraphic findings were correlated with the therapeutic measures needed to alleviate the priapism episode. Additionally, with subsequent clinical follow-up, the relationship between the

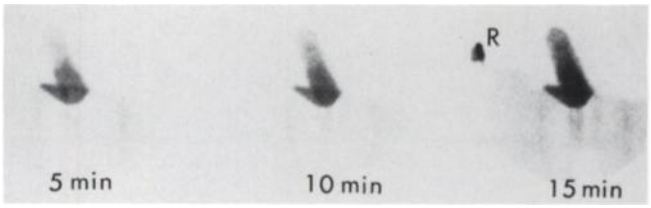


**FIGURE 1.** High-flow priapism (Patient 9). There is rapid progressive appearance of radiotracer activity throughout the penile shaft, indicating a nonstagnant state of the vascular perfusion.

scintigraphic patterns and eventual sexual potency in these patients was examined.

## RESULTS

Over 5 yr, we obtained 15 studies in 13 patients. Technetium-99m-pertechnetate was used in 13 studies and in vivo $^{99m}$Tc-RBCs in two. Two of the pediatric patients (Patients 6, 8) had a repeat study because of recurrent symptoms 3 mo and 11 days, respectively, following initial response to intracorporeal epinephrine and conservative treatment. Both patients had pertechnetate and a labeled RBC study. Five studies in one adult (Patient 9) and four pediatric patients (Patients 1, 3, 4, 7) had a scintigraphic finding of high-flow and ten studies in four adult (Patients 10, 11, 12, 13) and four pediatric patients (Patients 2, 5, 6, 8) had a low-flow finding. All patients with high-flow revealed tracer activity in the corpora cavernosa and corpus spongiosum within 15 min following the injection. Of the patients with low-flow, seven of eight had persistent lack of activity in the corpora cavernosa and one of eight demonstrated lack of activity in both the corpora cavernosa and the corpus spongiosum (Fig. 3).

Of the patients with high-flow, four of five had successful conservative treatment with analgesics and intravenous hydration, although one pediatric patient (Patient 3) also had an exchange transfusion as part of his therapy. Another pediatric patient with high-flow (Patient 1) had a stormy course and eventually required glans-cavernosa shunting (Winter procedure) for relief of his condition.

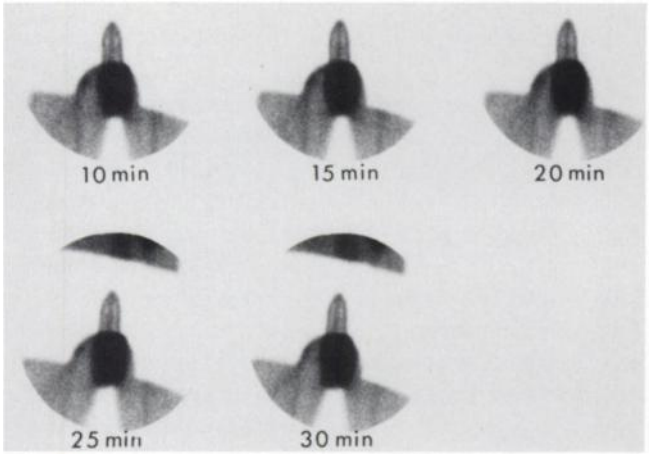


**FIGURE 2.** Low-flow priapism (Patient 10). As a result of circulatory stagnation, there is a persistent lack of arrival of tracer activity within the corpora cavernosa.

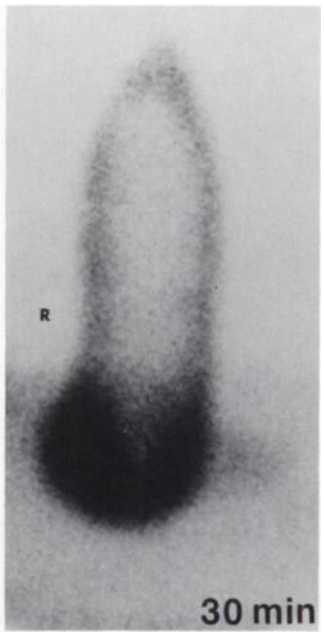


**FIGURE 3.** Tricoporal priapism (Patient 13). There is persistent lack of the tracer activity in the corpora cavernosa as well as the corpus spongiosum.

Of the eight patients with low-flow, two pediatric patients (Patient 2, 6) needed surgical shunting. One adult patient (Patient 12) had a Winter shunt 2 wk before the imaging procedure. Postsurgically, he had reduced but persistent priapism and his scintigraphic study showed unilateral low-flow (Fig. 4). He and another adult patient (Patient 13) who had a perfusion abnormality involving both the corpora cavernosa and corpus spongiosum subsequently required repeat corporeal irrigation and intracorporeal epinephrine. Another pediatric patient and two adults (Patients 10, 11) were successfully managed with analgesics and intravenous hydration only.

Impotence has been reported following childhood priapism (7). Two of our pediatric patients were subsequently lost to follow-up. Our other pediatric patients were eventually sexually potent irrespective of their scintigraphic finding, although temporary impotence following the major episode was noted in one post-pubertal patient (Patient 6). One adult patient (Patient 10) who had a low-flow scinti-

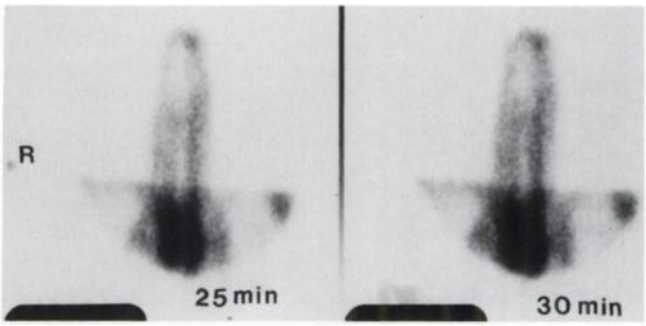


**FIGURE 4.** Unilateral stasis following glans-cavernosa shunt (Patient 12) with persistent lack of perfusion through the right corpus cavernosa.

**TABLE 1**
Patient Characteristics

| Patient no. | Age (yr) | Hb | Study performed | Scintigraphic finding | Treatment required | Complication/Outcome |
|---|---|---|---|---|---|---|
| 1 | 9 | SS | Pertechnetate | HF | Shunt | CVA 1 wk after discharge |
| | | | | | Ch Tr | Potent subsequently |
| 2 | 15 | SC | Pertechnetate | LF | Shunt | Lost to follow-up |
| 3 | 14 | SS | Pertechnetate | HF | Ex Tr | Potent |
| 4 | 14 | $SB^+$ | Pertechnetate | HF | A & H | Potent |
| 5 | 5 | SS | Pertechnetate | LF | Ex Tr | Lost to follow-up |
| 6 | 18 | SS | Pertechnetate | LF | I & E | Prior CVA (11 yr ago), on Ch Tr |
| | | | RBC | LF | Shunt | No erection × 3 mo after shunt |
| | | | | | | Potent subsequently |
| 7 | 12 | SS | Pertechnetate | HF | A & H | Potent |
| 8 | 12 | SC | RBC | LF | A & H | Potent |
| | | | Pertechnetate | LF | A & H | |
| 9 | 27 | SS | Pertechnetate | HF | A & H | Impotent |
| 10 | 38 | SS | Pertechnetate | LF | A & H | Potent |
| 11 | 26 | SS | Pertechnetate | LF | A & H | Prior episode of priapism treated with I & E 11 yr ago |
| | | | | | | Impotent |
| 12 | 22 | SS | Pertechnetate | LF(R) | I & E | Had Shunt 2 wk prior to penile scintigraphy with partially relieved priapism |
| | | | | | | Impotent |
| 13 | 26 | SS | Pertechnetate | LF(TRI) | I & E | Prior episode of priapism treated with Ex Tr and I & E 4 wk earlier |
| | | | | | | Impotent |

HF = high-flow; LF = low-flow; R = right side; TRI = tricorporal; Shunt = glans-cavernosa Winter procedure; Ch Tr = chronic transfusion regimen, maintaining HbS <30%; Ex Tr = exchange transfusion; A & H = analgesics and intravenous hydration; I & E = corporeal irrigation and intracorporeal epinephrine; CVA = cerebral vascular accident; SS = homozygous sickle cell anemia; SC = sickle-hemoglobin C disease; $SB^+$ = sickle-$\beta^+$ thalassemia.

graph claimed that he had no problem achieving an erection. The remaining adult patients, however, who had been observed for at least 10 mo, had persistent impairment of erection. The clinical data and corresponding scintigraphic findings are listed in Table 1.

## DISCUSSION

Priapism is a persistent painful erection not associated with sexual stimulation or desire and absence of detumescence following ejaculation. Most cases are either idiopathic in etiology or associated with sickle cell disease. Other causes include medications, such as antihypertensives, psychotropic agents and anticoagulants, and perineal trauma, leukemia, thrombo-embolic disorders, hematologic disorders, inflammation of the urogenital tract, central nervous system/spinal cord disorders, hemodialysis and bladder and prostate carcinoma (*8,9*). Most occurences of priapism associated with sickle cell disease are of short duration and are self-limited. Treatment is required only for those with prolonged or multiple recurrent episodes. While some patients respond well to analgesics and intravenous hydration with or without transfusion, others require corporeal aspiration/irrigation, intracorporeal epinephrine or glanscavernosa shunting.

While the management protocol of priapism may vary from one institution to another, most clinicians would agree that early intervention appears desirable for a major episode to lower the frequency of subsequent impotency, especially in adult patients (*10,11*). To select appropriate treatment, intracorporeal blood gas and intracorporeal pressure measurements have been recommended (*12*). These procedures are, however, invasive. Doppler ultrasonography, which is much more commonly utilized in the detection of vascular insufficiency in patients with impotence (*13,14*), has occasionally been helpful when applied in priapism (*15*). There remains a need for a noninvasive procedure which may help in the management of such patients.

Penile scintigraphy as reported by Hashmat et al. (*2*) and performed in our patients reflects the state of vascular circulation through the penis. Conceivably, circulatory stagnation due to sickling and sludging in the cavernosa spaces could impede and delay the arrival of the radiotracer to the penis. Therefore, this vascular occlusive form of priapism is frequently expressed as low-flow by scintigraphic imaging. On the other hand, so called scintigraphic high-flow actually indicates a relatively more rapid appearance of tracer activity in the organ and not necessarily a true increase of penile arterial perfusion above that of normal subjects. Obviously, it does not correspond to the type of priapism caused by actual persistent increase of arterial in-flow, first described and named as high-flow by

Hauri (*16*) and later elaborated by Witt (*15*). This clinical type of arterial priapism had been observed following perineal or cavernosal trauma in which the penis showed livid discoloration and there was less penile firmness than the stasis type. For this entity, accelerated penile venous outflow and a focal area of increased contrast density were demonstrated by carvernosography, cavernosal arterial blush and hypervascularization were revealed by selective angiography and strong corporeal artery pulsations was shown by Doppler ultrasonography. To avoid confusion, it would be better to distinguish the two different forms of scintigraphic patterns as stagnant and nonstagnant priapism rather than low-flow and high-flow priapism. Based on the degree of circulatory stasis, it is not surprising that patients with the nonstagnant scintigraphic pattern responded better to conservative treatment than those with the stagnant pattern. Scintigraphy does provide an insight to the degree of ischemia. By identifying those patients with nonstagnant priapism, conservative therapy can be more confidently continued. Impediment of the blood flow, however, which results in a scintigraphic stagnant pattern does not always necessitate aggressive therapy, as observed in four of eight of our patients.

Impotence has been reported to have a higher incidence in patients with tricorporal priapism (*17*), which occurred in one of our patients who had this scintigraphic finding. From the data of our other patients, however, it does not appear that scintigraphy can help predict sexual potency in patients following a prolonged episode of priapism. In general, the prognosis of sexual function appears less favorable for older patients presenting with priapism. Perhaps the age of the patient alone may be a more reliable predictive factor.

## CONCLUSION

Penile scintigraphy appears to be a promising diagnostic tool for the evaluation of priapism in patients with sickle cell disease. Additional studies are warranted to fully evaluate the merit of this imaging procedure not only for patients with sickle cell disease but also for the nonsickle cell population who suffer from veno-occlusive priapism.

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