

# Peno-Scrotal Skin Losses, Repaired by Implantation and Free Skin Grafting \*

## Report of Known Normal Offspring (Preliminary Report on Total and Deep Losses)

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"RESTORATION of the Entire Skin of the Penis" was reported, by one of us, in 1937 in a series of patients started in 1930.<sup>2</sup> The losses resulted from granuloma inguinale, gunshot wounds, and slough following circumcision. Since then patients have been cared for, with both surface and deep losses, from war injuries, and from chemical slough from injection. Another notable group of injuries has occurred in farm and industrial accidents, in which the entire skin of the penis and the scrotum is avulsed and lost. These injuries may be complicated with tearing back through the perineum into the rectum, and up over the abdomen and around one flank to the spine (Figs. 1 and 2).

Complete avulsion of the skin of the penis and of the scrotum, needless to say, creates a very acute problem for life, for saving the testes, for covering the penis, and for gaining rehabilitation of the functions of the area. The sight of the completely deuded penis and the testes left uncovered, hanging by their cords, is a critical one for all concerned (Figs. 1 and 2).

We have called this the "power take-off injury," as it usually results from the overall leg being caught in the turning shaft of auxiliary power on the side of a tractor, on a bolt through the power take-off at the first universal joint. The patient may be

pulled out of the seat, or it may happen while climbing into the tractor. The trouser leg is caught and twisted up the leg to the genital region, where it engages the skin of the scrotum and the penis and completely avulses it. The skin tears loose at the corona, so that the glans is usually left intact. The tearing may rip backwards into the rectum and there may be further avulsion up over the abdomen, flank and back (Figs. 1 and 2).

There is not as much pain as would be expected at the start, but it may be severe later. Unconsciousness or severe shock has not been noted, but this would depend on how soon help was at hand. The skin specimen, in one piece, is usually recovered and brought in with the patient, though it may be contused, and may have been on the ground (Fig. 1B).

This type of injury does not seem to damage the deep erectile tissue or the spermatic cord. The skin is so loose that it is pulled off of the body to break away at the glans. The separation is probably along the dartos fascia, with the testes held back separately (Fig. 1A).

Prompt evacuation and operation is obviously indicated and transport for definitive care is most advisable. If delay in final hospitalization is unavoidable the testes can be saved by implantation just under the skin of the thighs, and the penis can be dressed, or implanted temporarily under adjacent skin (Fig. 2A). For these dramatic

\* Presented before the Southern Surgical Association, Boca Raton, Florida, December 4-6, 1956.

injuries consultation may be held by telephone, and the local surgeon can carry out implantation of the testes, instead of just dressing them open with the added possibility of twist or thrombosis of the spermatic vessels.

#### OPERATION

The full procedure is shown in Figure 1 and the legends of illustration are referred to as part of the text. There is complete loss of all skin, the perineum is open and there is some loss above, and the skin specimen has been sent in for possible use.

There are four operative procedures to be carried out at one time, if possible: (1) The perineal defect is closed, (2 and 3) both testes are implanted just under the skin of the thighs and (4) the penis is grafted with a thick split skin graft taken from the thigh (Figs. 1, 2 and 4).

*Testes Implantation Under Skin of Thigh.* A short incision is made on each thigh at proper level and the skin is elevated superficially so that the testes may rest just under the skin. A tunnel is completed on up to the lateral opening of the tear above so the spermatic cord may descend as directly as possible to the pocket just under the thigh skin. Each testis is gently pulled down through the tunnel to the superficial pocket just under the skin at a level of a normal scrotum, with great care to maintain the cord without blockage or twisting. This eases the situation a great deal, with the grafting of the penis remaining (Figs. 1C and 2A).

*Grafting the Completely Denuded Penis.* Catheterization is necessary (which probably already has been carried out). The penis is elongated to its full extent on the catheter and a thick split graft from the thigh (or other suitable non-hairy area) is applied (Fig. 4). Any irregular edges of skin are trimmed away. Firm pressure-fixation with a local and a spica dressing is important, and is maintained for five days and reapplied for ten days longer.

It is possible to effect full coverage and restoration of function in this one procedure of four operations at the single operating room visit (Figs. 1 and 2).

If there is need for further graft, or loosening, more skin can be added later. In the patient with the widest loss (Fig. 2), including a large area on the abdomen, additional freeing and grafting was done at the base one year later. In another patient tightness in one area was relieved two years later with opening and grafting the defect.

The details of grafting as described in our 1937 paper are about the same.<sup>2</sup> If there is retraction, from delay in the grafting, with actual contraction of the shaft of the penis, the granulation and scar tissue is removed carefully until the penis can be fully drawn out.

*Type of Graft.* We feel that a thick split graft from a relatively hairless area is most adaptable. The avulsed skin is apt to be very soiled and it does not lend itself to free grafting. We realize that others have had success with grafting the avulsed skin, and decision on its use is a detail to be met at the time of repair. But it is established that the split graft can be used, as we had to in our earlier series when there was complete loss from disease and from slough. Of course this same thing still applies, and when there isn't any of the penile skin available some other source must be found (Fig. 4).

The thickness of the graft is about two-thirds that of the site from which it is taken. Full thickness grafts are not used as being more difficult of obtaining a take, but there is no reason why they couldn't be used, if desired as a point of technic. We do not see any use in risking the chance of take when the thick split graft is satisfactory. Supra-clavicular full thickness grafts may be useful in some small, deep losses.

Pedicle flaps seem to have no place in full resurfacing as being too cumbersome and thick, subject to increase in fat and not giving as normal final sensation as a free



FIG. 1A.

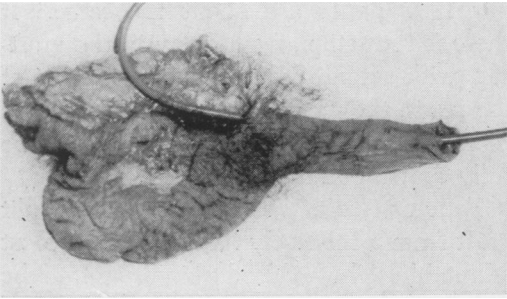


FIG. 1B.

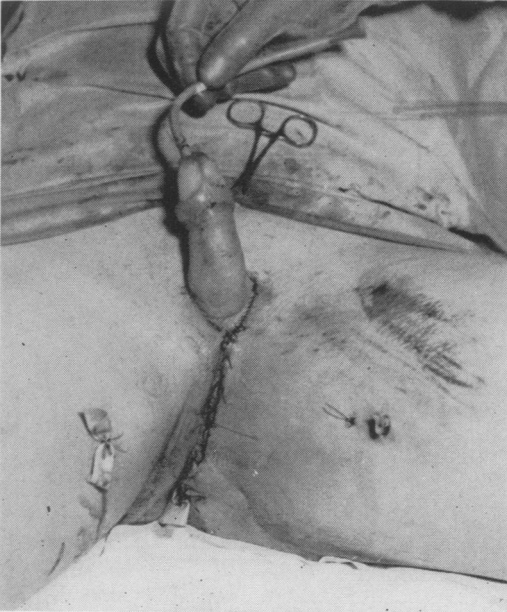


FIG. 1C.



FIG. 1D &amp; E.

FIG. 1. (A) Complete avulsion skin of penis and scrotum and up onto abdomen, tear through perineum into rectum. Testes left hanging separately with cords intact. (B) Completely avulsed skin in one piece. (C) Five days after operation in which testes were implanted just under skin of thighs. Perineum and anal ring were closed. Thick split skin graft from thigh for resurfacing penis. (D & E) Final result with normal function. No further surgical work or revision needed.

graft. One text shows flaps from the hairy abdomen, and from the scrotum for full coverage, but neither are indicated for any

more than temporary "storage" of the penis while awaiting grafting.

One qualification about flaps, however,



FIG. 2A.

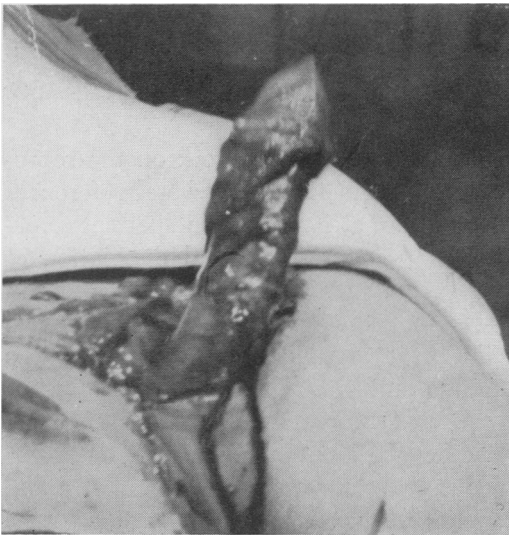


FIG. 2B.

FIG. 2. (A) Complete avulsion skin of penis and scrotum, extensive flap torn loose up over abdomen to costal margin, and around flank to spine. Perineum torn clear open. Perineum and rectum closed, testes implanted just under thigh skin, abdominal and back flap sutured into place. Penis "stored" under left lower quadrant tunnel. This life and testes saving work carried out by Dr. William G. Kraybill, Pittsfield Hospital, Pittsfield, Illinois; patient then sent in for repair of penis. (B) Penis removed from "storage" tunnel, and resurfaced with thick split grafts from the thigh. (One year later more skin was added to penis after release of scare at base.) (C, D & E) Patient has normal function. Testes just under skin of thigh tend to



FIG. 2C.

form their own scrotum. Patient not desirous of any attempt at making scrotum (as none of the patients have been). Father of normal baby 9 years after accident, establishing that the method is compatible with normal spermatogenesis as much as eight years after the accident and that it is applicable for saving life, saving testes and allowing normal function. (F & G) Shows extent of avulsion over the abdomen, flank and back and final repair with thick split skin grafts in one operation.

is that they may be needed for the repair of deeper destruction or loss as will be cited later.

*Rehabilitation and function.* Following this severe injury it is possible for patients to lead normal lives, to be married, and to have children (Figs. 1 and 2). Known normal offspring has been definitely demonstrated by one of our patients. He was injured and repaired in August, 1947, married in 1955, and a normal baby girl was born in 1956 (Fig. 2).

During the gap in publication of these methods from 1937 to 1956 the work has been presented many times at meetings in this area and in the farm belt where the

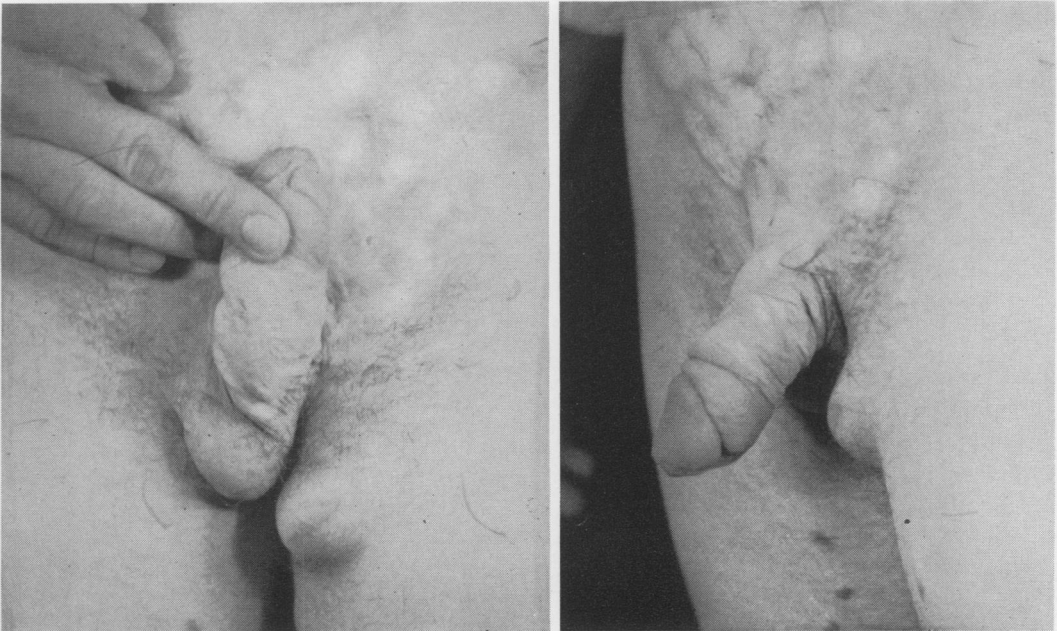


FIG. 2D &amp; E.

accident is most apt to occur. An earlier report has been put in our chapter #45 on the "Principles of Plastic Surgery," in a textbook of surgery by Moyer, Allen, Harkins and Rhodes which is in press.<sup>3</sup>

*Temperature Influence on Spermatogenesis.* Through personal communications and visits here by Dr. Carl R. Moore the matter of influence of temperature on spermatogenesis was considered at length, but his untimely death came before we had confirmation of known offspring by one of our patients with the testes under the skin of the thigh. We had heard of two other instances of offspring by such patients in Kentucky, which were related to Dr. Moore before his death. These instances were not reported in the literature and we have misplaced our data about them.

Moore felt that the implantation just under the skin of the thighs was the best procedure and he felt that bringing the testes out any further with local flaps was not indicated, especially on seeing photos of patients who showed marked prominence of

the testes just under the skin (Figs. 2C, D, E).

Moore's outstanding work on the reproductive system includes several references to the thermal influence on spermatogenesis.<sup>10, 11, 12, 13, 14, 15</sup> He found dissolution of the spermatogenic cells on elevating adult testes into the abdomen. This suggested some heat regulation or control by the scrotum, and this possibility was suggested by Crew.<sup>6</sup> Moore<sup>12</sup> showed the effect of heat and the function of the scrotum in further experiments and the finding was confirmed in humans by Harrenstein.<sup>9</sup> One method of Moore<sup>11</sup> was to insulate the testes of rams and produce degeneration of the tubules. Phillips and McKenzie<sup>16</sup> confirmed this observation. Fukui<sup>8</sup> studied the heat problem in experimental animals and suggested it in one patient with disease of the scrotum. Moore<sup>14</sup> summarized the findings, "The scrotum is well adapted to serve a thermo-regulatory function because of its special characters." "Thus these —experiences enable us for the first time

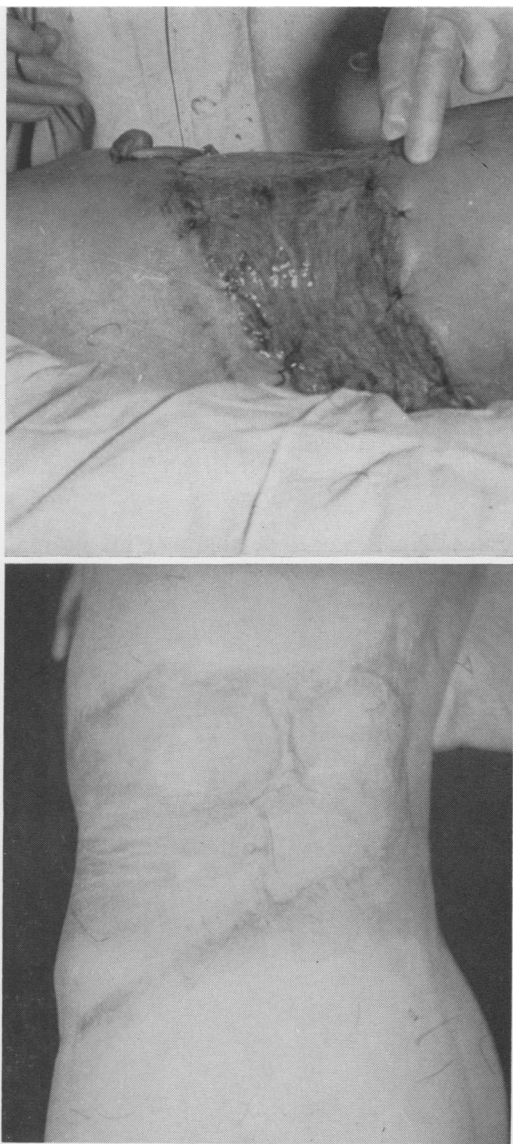


FIG. 2F & G.

to assign to the scrotum a definite function, —especially as it is related to germ cells.”

*Discussion of Implantation of Testes.* The reason for these references is that there may be argument for attempts at reconstructing a scrotum, or for coverage with grafts or thin flaps rather than the thigh implantation. So that the surgeon confronted with the patient may have to decide this technical problem as he sees best. It seems to us that the most expedient pro-

cedure is to implant the denuded testes just under the skin of the thighs as the best means of saving them at the time of the accident. This provides a blood supply with preservation of the cord, in a direct line to the testes. And since the testes seem to function properly, are well protected, and normal offspring are possible, it seems best to leave them under the thigh skin unless the patient wishes further attempt at scrotal formation. We have noted (Fig. 2) that the testes tend to form their own scrotum and to extend outward in their pockets. When there is recovery one could then consider whether it would be indicated to bring the testes still further out by the use of local flaps.

If it is decided by the patient or thought advisable by the surgeon the testes can be brought further out from the thigh by a flap operation and more of an assimilated scrotum can be developed. The skin of the inner thigh is thinner and perhaps more desirable than towards the lateral side, but with the testes implanted towards the inside in the first place, this part of the covering can be left intact and a flap, raised either laterally or inferiorly, can be applied to the undersurface of the testis. The defect of the flap can be closed directly or grafted, if needed. This allows the testes to be more prominent, but it is, of course, not established whether this is better than the position just under the skin. If there is complete healing and softening of the surrounding area for several months the bifid scrotum can be united in mid-line.

This procedure can be followed out primarily if thought desirable as a point of technic, but in most instances the superficial implantation is thought to be the best and safest.

*Total and Deep Losses of Penile Substance.* Presumably deeper injury might occur in these accidents, but in our series deep loss of the penis, in whole or in part, has been due to gunshot injury or slough from injection at the time of circumcision.

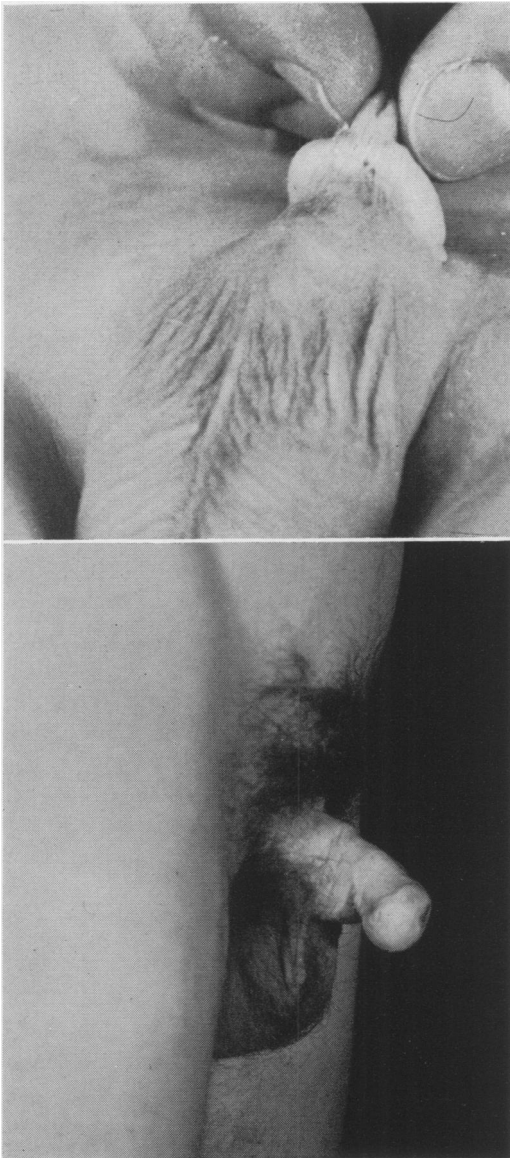


FIG. 3. (A) Practically non-existent penis, result of slough following circumcision. (B) Normal function and size restored in two dissections and forward movement of bulbar penis and grafting. Scrotal flap used at base. Four reconstruction operations in four years. Result satisfactory and patient not desirous of further work.

There may be congenital absence of recognizable penis, or it may be mistaken for clitoris in severe hypospadias. One patient was seen who had lived as a girl for 13 years, but on final recognition of the penile structure, and freeing it, and closing the

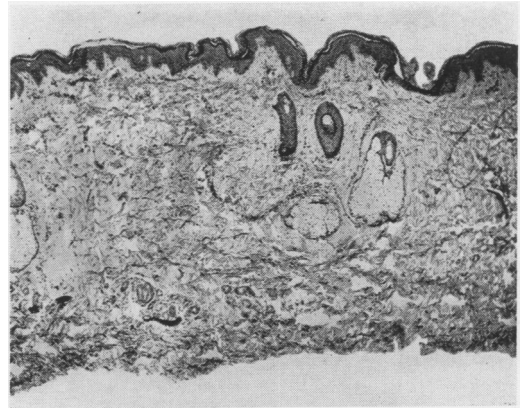


FIG. 4. Thick split skin from thigh, about  $\frac{3}{4}$  of the full thickness of the skin. Type used in these patients.

open area, the patient assumed his normal male status in life and has been successfully married.

A note of losses of the penis down into the erectile tissue, is included for completeness and to make a preliminary report of reconstruction of such losses. These occur mainly from gunshot injury, but one of the worst seen resulted from acid having been injected at the time of circumcision. Marked retraction and deformity of any remaining tissue is present with no hope for normal function. In practically total loss from acid injection, rehabilitation was possible in three graft operations and three fistula closures, so that a practically non-existent organ was developed along with satisfactory function (Fig. 3).

The method of repair was carefully to dissect off the scar, leaving anything that might be erectile tissue, mobilize the bulbar part of the shaft, gently free it from its position under the pubis and extend it on a catheter as far as possible. Free thick split grafts and a rotated scrotal flap were used for coverage. This dissection of the stump and grafting seem superior to the popular idea, of Russian origin, of using a lined tubed flap with a piece of costal cartilage in it. This can only leave an inert, insensitive organ with only a stretch of the imagination construing an inert costal car-

tilage to be erectile. Whereas this flap appendage might appear more normal than the above method of getting all normal tissue available, it does not seem that function could be the same. The above method of mobilizing the bulbar part and grafting it in stages has been used for complete amputation with satisfactory function established. Here again, however, the wishes of the patient must be considered in final rehabilitation.

*Prevention.* Many of the accidents in our patients could have been avoided. Injection for such a small procedure as a circumcision is extremely important as shown by such losses as these, and their sequelae. Prevention of war injury is not in the realm of the surgeon except as his reports may show the uselessness and stupidity of the whole thing. Farm and industrial avulsions are preventable except for the human error that gets around ironclad protection. One of our patients in answer to a query as to whether he had guards on any tractors he might have, to try to prevent such accidents, sent in this answer, "All equipment of this type is equipped with the proper guards."

#### SUMMARY AND CONCLUSION

Total loss of the skin of the penis and scrotum occurs in farm and industrial accidents and from other causes. The "power take-off" injury rips the entire skin off, in one piece, and may tear back into the rectum, and up over the abdomen, chest and flank.

Prompt evacuation and operation can save life and the testes, and result in complete rehabilitation and normal function. The testes are implanted just under the skin of the thighs and the penis is covered with a split skin graft. Normal spermatogenesis has been shown as evidenced by normal offspring, as long as eight years after operation. It also has been established in earlier reports, 1937, as well as here, that thick split skin grafts will give normal function in resurfacing the denuded penis.<sup>2</sup>

A review of the effect of temperature on spermatogenesis is included, as well as a preliminary report on procedures for total and deep loss of penile structure.

*Subsequent Note.* Since preparation of this paper there have been two publications on this subject. One of them<sup>7</sup> relates thigh implantation in three patients in the past four years, with report of offspring by one patient. The authors report the superficial thigh temperature about the same as the scrotum and the deep thigh as being appreciably higher.

The other publication, from India, relates one patient with loss of scrotal skin only, and repair with a free split graft in two stages. Marriage, without children after five years, and decline of testicular function is reported in observing this one patient.<sup>1</sup>

There also has been one textbook in 1956 on the plastic repair of genito-urinary defects in which denudation of the penis is covered in two lines and two drawings of abdominal and of scrotal flaps. No mention is made of avulsion of scrotal skin or of combined avulsion of penis and scrotum, nor any mention made of implantation of testes. There are two drawings of flap coverage of testes presumably following gangrene, but these drawings are not referred to in the text.

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DISCUSSION.—DR. TRUMAN G. BLOCKER, JR., Galveston, Texas: I would like to compliment Dr. Brown on the very nice group of cases of this type which he has shown. In 1935 I assisted Dr. R. E. Cone, a former member of this Association, now deceased, at the University of Texas on a case similar to the first one shown by Dr. Brown. This patient has also become a father since that operation. Dr. Cone implanted the testes as has Dr. Brown, and we did a skin graft of the penis with a large free-hand split graft (this was before the dermatome). Our patient's child was also a female. I wonder whether the occurrence of Y chromosomes has something to do with increased warmth which follows implantation into the thigh.

DR. BEVERLY DOUGLAS, Nashville, Tenn.: In 1949, before this Association, I reported a case of which I want to show a picture, and I want to congratulate Dr. Brown on his splendid and comprehensive dissertation on this subject. My only point of difference would be that I personally feel that it might be better in the long run to make the scrotum from the flap or, later on, to lift the flap over the testes, bring them over and form a scrotum. This makes the patient somewhat happier, and I am sure it will not interfere with spermatogenesis in any way.

(Slide) You can see on the left above that this man had the entire skin of the penis and scrotum avulsed in the same kind of accident,

and I pause here to say that it is a pity that an injury which could be prevented by simply covering a moving shaft has not been prevented by the manufacturers making these machines. Most of these injuries occur on threshing machines. They would not let machinery on an automobile, for instance, be exposed in this fashion. In this case the pants were rolled up, caught the scrotum, and off it came with the skin of the penis.

The repair was carried out at that time in one stage. Flaps were formed as you see, brought over to the midline and the testes were tucked in there and the scrotum formed. The areas on the penis were grafted as I said, and I agree with Dr. Brown, by a thick split graft, the scar line being placed on the dorsum of the penis. In 22 days the wound was healed and this shows how the scrotum was scooped out and all wounds healed.

(Slide) The other case was one who had almost the same condition as in the case Dr. Brown mentioned. As you see from the diagram made at the time there was no skin left. I advocate, as does Dr. Brown, placing this under a double pedicle flap on the donor. This was put over the entire skin on the shaft of the penis, but wherever possible I think this should be covered by a thick split-graft. In this case I do not believe it would have taken because there were three fistulae which had to be covered. Again I want to thank Dr. Brown for bringing this up because it is a very fine review of patients and the results obtained.