INTRODUCTION

Tubularization has been used in the clinical practices of all reconstruction techniques in which a lumen is required, especially in the repair of hypospadias. Tubes can be formed either by a flap, graft or by an incision. The history of tubularization goes back to the advent of hypospadias. Hypospadias is one of the most frequently encountered anomalies, the definition and repair of which were made a very long time ago. In fact, it has an incidence of 1/300 [1]. The disease is treated with various tubularization techniques. A midline incision of the urethral bed was first used by Rich et al in Mathieu and only island flaps to obtain an acceptable cosmetic appearance [2]. Snodgrass described a novel technique using this incision and claimed that the technique could be performed easily in most of the patients with hypospadias [3]. He reported a considerably low rate of complications and maintained that the technique did not cause any stricture and that tubularization was performed with success and did not require an additional skin [4-7]. In the subsequent years, there have been other studies on Snodgrass’ technique and the technique has been used widely [8]. The objectives of surgical intervention in the treatment of hypospadias are to form a normal urethra, cause a low rate of complications and obtain a good cosmetic appearance [4]. Among the most common complications in the surgical treatment of hypospadias are urethrocutaneous fistula and strictures. In this double blind study, we described a novel tubularization technique using double incision and compared its effects on wound healing and lumen diameter with those of other tubularization techniques. Based on the obtained promising results, we applied the tubularization with double incision in four patients.

MATERIALS AND METHODS

This study was carried out in Laboratory of Experimental Studies, Adnan Menderes University. We used 8 New Zealand white rabbits weighing between 2-3kg. Each rabbit was put in a separate cage. After they adapted to the environment, the experiments were done. The whole back was shaved in all rabbits. They were anesthetized intramuscularly with 0.03 mg/kg. medetomidine and 3mg/kg. ketamine injections given for induction and additional maintenance. One surgeon formed 32 tubes from dorsal skin of the rabbit in size of 8x20mm, using four types of tubularization technique (Figure 1). The operations were performed under aseptic conditions. Flaps were marked in each group in accordance with the measurements made before.

Flaps: First, skin incisions were made down penileus carnosus. Then, flap margins of 2mm were elevated and turned in around a silicon catheter to form tubes.

Grafts: First, the skin on the back was elevated from its bed. Second, the grafts were turned in around a silicon catheter to form tubes. Finally, the tubes were transferred to the area of the defect.

Single Incision: First, incisions were made in accordance with those of the flaps. Second, the flaps were elevated. Third, a single vertical incision was made on the middle of each flap. Then, the tubes were formed on a catheter.

Double Incision: Flaps were harvested as in the single incision. However, double vertical incisions at 2cm-intervals were made on the middle of each flap (Figure 2).

Tubularization was performed using an 8F catheter and 7/0 PDS suture (figure 3). The ends of the tubes were sutured using 4/0 prolene and thus, the tubes were buried. Then, the animals were put into their cages and received a standard wound care for 21 days. At the end of this period, the tubes were removed blindly and fixedated with formalin 10%. All animals were put into their cages and received a standard wound care for 21 days. At the end of this period, the tubes were removed blindly and fixedated with formalin 10%. All analyses were made on three samples, obtained from the two ends and the middle of the tubes each sample was stained with Hematoxyline Eosin (figure 4) and Masson Trichrome (figure 5) for histopathological examination. Microscopic examinations were performed by one pathologist blindly. On histopathologically examinations, the characteristics of re-epithelization, nature of inflammatory cells and degree of collagen deposition were evaluated.

Hematoxyline eisin was used to determine whether inflammation was present. On histological examination, the presence of few neutrophil and occasional lymphocytes under the epithelium was considered as mild inflammation, the increased number of inflammatory cells with their occasional infiltrations into the epithelium as moderate inflammation and the presence of inflammatory cells causing destruction of the epithelium as severe inflammation. Results were evaluated according these observations and used a scale between “0 to 3”. Masson Trichrome was used to determine the presence of collagen in the connective tissue. Observations by the pathologist were summarized according to concentration of the collagen and used a scale between “0 to 2”.

Diameters of the tubes were measured using the microscopic method technique microscopically.

SPSS package program 10.0 was used for statistical analysis. Mann-Whitney One Way Analysis of variance test was used to compare the groups and Kruskal-Wallis test to determine differences between the groups.

RESULTS

No rabbit died of the procedures, and 21 days after the
Figure 1: Dorsal skin of the rabbit. Pre-operative view. Randomized four types of tubularization were performed.

Figure 2: Preparation of flap with double incision technique. I indicates first incision, II indicates second incision.

Figure 3: Preparation of flap over the 8F catheter by using 7/0 PDS.

Figure 4: Microscopically view of the specimen (Hematoxyline Eosin staining, X 100 magnification)

Figure 5: Microscopically view of the specimen (Masson Trichrome staining, X 200 magnification)

Figure 6: Clinical application of the double incision technique. Both feet of the forceps indicate the incisions.

Figure 7 and 8: Tube was created very easily without tension by double incision technique.
in the distal urethral plate was first described by Rich in 1989. Urethral strictures constitute a significant problem that often requires long term treatment and thus some cause other than ischemia seems most likely, although at present elusive [17]. Urethral strictures refer to the immediate elastic recoil of a graft as it is cut [14]. The contraction of a healing graft and wound is referred to another site where it will develop a new blood supply. The new lumen must have a diameter as large as the original lumen, and the tissue integrity must be preserved. An ideal technique should be easy to perform, acceptable in most of the cases, performed in one stage and have the lowest rate of complications. However, the techniques described so far do not have the above-mentioned characteristics. Each technique has both advantages and disadvantages.

Hypospadias is a clinical condition, for which more surgical treatments have been described than for other clinical conditions. The reason why so many surgical procedures have been described for its treatment is lack of a simple solution to the problem and the desire to minimize the complications. The goal of hypospadiac surgery include a straight penis with a urethral meatus at the tip of the glans, a well vascularized neourethra of adequate caliber with a solid, straight urinary stream and achievement of sexual function when mature [13] Oribaus’ Works (25 to 103 A.D) trans-dorsal incision and formation of a ventral tube [10]. All the techniques require tubing of the tissues and transfer of the tissues from another part of the body and are applied in a single or multiple stages. Flap is a tissue that is transferred from one area of the body to another area with is original blood supply intact. But skin graft is skin that has been completely detached from its original donor site and transferred to another site where it will develop a new blood supply. The outcome in all procedures is directly related to wound healing. It is debatable that graft causes contraction. Contractile fibroblasts, known as myofibroblasts, contract open wounds [14]. The contraction of a healing graft and wound is referred to as a secondary contraction. In contrast, primary contraction refers to the immediate elastic recoil of a graft as it is cut [15] Secondary contraction is clinically important. As stricture and fistulae are frequently encountered in the clinical practice, the use of graft has been gradually decreased [16]. In this study, the smallest diameter of the lumen and unfavorable results of the wound healing were obtained by graft.

Tubed flaps should theoretically have a sufficient blood supply and thus some cause other than ischemia seems most likely, although the present elusive [17]. The depth of the incision is another issue to be explained in Snodgrass technique, since there was no data related to exact depth of incision. Dr. William Cromie’s asked how deep the incision should be. Snodgrass, in the discussion of his study in 1999, explained that the incision should be deep enough to allow the relaxation sufficient to perform tubularization [6]. In our study, using double incision, we formed the tubed tubes easily and the incision did not cause tension. This modification is more advantageous in that it is easy to form tubes and that the technique does not cause tension even in the secondary treatment and in the presence of scar.

Several investigators attempted to minimize the scars likely to be caused by the conventional Snodgrass repair, and therefore, elevated free grafts from preputial skin [12]. However, these attempts were inconclusive. In the present study, the results of the experiments supported the findings from Snodgrass’ studies. In addition, double incision did not cause any complication and furthermore, a larger diameter of the lumen was reached.

<table>
<thead>
<tr>
<th>Group name (min - max)</th>
<th>Inflammation (min - max)</th>
<th>Collagen concentration (min - max)</th>
<th>Lumen diameter (min - max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.Flapp group</td>
<td>(0 - 2) 0.5</td>
<td>(0 - 1) 0.3</td>
<td>(100 - 175) 120</td>
</tr>
<tr>
<td>2.Graft group</td>
<td>(1 - 3) 2.14</td>
<td>(0 - 1) 0.5</td>
<td>(95 - 130) 121</td>
</tr>
<tr>
<td>3.Single incision</td>
<td>(1 - 2) 1.1</td>
<td>(0 - 1) 0.5</td>
<td>(100-175) 128</td>
</tr>
<tr>
<td>4.Double incision</td>
<td>(1 - 2) 1.3</td>
<td>(0 - 1) 0.5</td>
<td>(110-190) 150</td>
</tr>
</tbody>
</table>
inflammation in the skin after incision and closure. However, around the urethra after urethrotomy were anticipated, as was healing in rabbits [26]. Inflammation and fibrosis in and spadias has been usually based on the clinical observations; hypospadias. Wound healing after the treatment of hypo- formation of fistulae and stricture following the treatment of hypospadias. We formed tubes in the dorsal region of the rab- This study focuses on tubularization for the treatment of hy- no single model has been described. We think that double incision will facilitate the procedure. CONCLUSION Hypospadias is one of the conditions encountered in pedi- urachal stricture tissue. J Urol 1993;150: 642-7.

References: