

1 **Distal hipospadias onarımında ‘Sınırlı Üretral Mobilizasyon Tekniği’ ile tatminkar**

2 **sonuçlar**

3 **Özet**

4 **Amaç:** Distal hipospadias onarımında Sınırlı Üretral Mobilizasyon (SÜM) tekniğinin
5 kullanımının değerlendirilmesi.

6 **Hastalar ve Yöntemler:** Altı yıllık dönemde SÜM tekniği ile onarımı yapılan 47 distal
7 hipospadias olgusu yaş dağılımlarına göre 2 gruba ayrıldı. Grup 1 (n=37) 6–36 ay ve Grup 2
8 (n=10) 37–72 ay aralığındaki hastaları kapsıyordu. Meatus lokalizasyonu 31 hastada glanüler, 7
9 hastada koronal ve 9 hastada sub-koronal idi. Altı hastada kordi ve iki hastada ventral cilt
10 kısalığına bağlı glans eğriliği mevcuttu. Dokuz hasta daha önce hipospadias operasyonu
11 geçirmişti. Operasyonda, meatusun proksimalindeki üretra glans tepesine rahatça gelebilecek
12 seviyeye kadar serbestleştirilerek glans içinde hazırlanan yatağa yerleştirildi. Üretra glans
13 kanatlarına sabitlendikten sonra glans onarımı yapılarak operasyon sonlandırıldı. Operasyon
14 süresi, üretral meatus ile glans tepesi arasındaki uzaklık ve üretral mobilizasyon uzunluğu
15 ölçüldü. Operasyon sonrası komplikasyonlar kaydedildi.

16 **Bulgular:** Grupların operasyon süreleri benzerdi. Her 2 grupta da gerilimsiz bir anastomoz
17 yapılabilmesi için üretral mobilizasyon uzunluğunun, meatus ile glans tepesi arasındaki uzaklığın
18 3 katı olması gerektiği saptandı. Bir hastada meatotomi gerektiren meatus darlığı gelişti. Fistül ve
19 meatus retraksiyonu saptanmadı.

20 **Sonuç:** SÜM tekniği distal hipospadias olgularında yüz güldürücü bir yöntemdir. Yeni bir üretral
21 tüp oluşturulmadığı için fistül riski yoktur. SÜM tekniği ile hastalarımızda glans tepesinde
22 yerleşimli normal idrar akımına izin veren ‘yarık şeklinde meatus’ oluşturulabilmiştir.

23 **Anahtar sözcükler:** Hipospadias, sınırlı üretral mobilizasyon

24

25 **‘Limited Urethral Mobilization Technique’ in distal hypospadias repair with satisfactory**
26 **results**

27 **Abstract**

28
29 **Objectives:** To assess the outcomes of Limited Urethral Mobilization (LUM) technique in distal
30 hypospadias repair.

31 **Patients and Methods:** Forty-seven patients, who were operated with LUM technique in 6 years
32 period, were grouped according to their ages. Age distribution in Group 1 (n=37) and Group 2
33 (n=10) were 6-36 and 37-72 months. Meatal localization was glanular in 31, coronal in 7 and
34 sub-coronal in 9 patients. Nine patients were secondary cases. Urethra proximal to the meatus
35 was mobilized for a distance sufficient to allow it to reach the glans tip without tension. Then, the
36 urethra was placed in the glanular bed and glanular reconstruction was performed. Operation
37 duration, the distance between the urethral meatus and the glans tip; and urethral mobilization
38 length were measured and post-operative complications were noted.

39 **Results:** Operation durations were similar in both groups. Three-fold urethral mobilization was
40 sufficient for construction of tension-free urethra-glanular anastomosis. No fistula, retraction of
41 the urethral meatus and chordee were observed. One patient required meatotomy.

42 **Conclusion:** Distal hypospadias repair with LUM technique is simple and effective. As no new
43 urethral tube is constructed there is no risk of fistula. Slit-like urethral meatus with good
44 functional results was obtained with the use LUM technique.

45 **Key words:** Hypospadias, limited urethral mobilization

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49 **Introduction**

50
51 Hypospadias is defined by an abortive development of the urethral spongiosum and
52 ventral prepuce along with an arrest in the normal embryological correction of penile curvature.^[1]
53 It is one of the most common congenital anomalies, which occurs in approximately 1 of 200 to 1
54 of 300 live births.^[1,2] Majority of the cases are distal hypospadias with an incidence of 75 %.^[2]
55 The main goals in hypospadias surgery are penile straightening, urethroplasty, meatoplasty and
56 glanduloplasty, scrotoplasty, and skin coverage.^[1] The success of the operation is determined by
57 excellent cosmetic appearance and normal voiding in straight forward direction from the tip of
58 the glans.^[1,2] Various surgical techniques were developed to achieve these objectives.^[3] The fact
59 that more than 300 different operations are described in the literature reflects the wide spectrum
60 of the anomaly, and proves that the treatment has not been perfected.^[1,3]

61 Any technique to repair distal hypospadias should be simple, easy and applicable with
62 good cosmetic and functional results. Herein, we report 47 patients with distal hypospadias who
63 were operated with Limited Urethral Mobilization (LUM) technique.

64
65 **Patients and Methods**

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67 Between January 2004 and January 2010, LUM technique was used in 47 patients for
68 correction of distal hypospadias. The patients with glanular (n=31), coronal (n=7) and sub-
69 coronal (n=9) hypospadias were included in the study. Six patients had minimal chordee and 2
70 patients had glans tilt related to shortage of ventral skin. Three patients had already undergone
71 MAGPI (meatal advancement glanuloplasty), and 6 patients TIPU (tubularized incised plate
72 urethroplasty) repairs and subsequent circumcisions with unsuccessful results. Two of these
73 secondary cases had sub-coronal and 7 had glanular meatus prior to our operation. Age

74 distribution of the patients was 6 months to 6 years. The patients were classified into two groups
75 according to their ages. Group 1 contained 37 patients with age range of 6 to 36 months and
76 Group 2 contained 10 patients with age range of 37 to 72 months.

77 All the operations were carried out under general anesthesia and performed by two
78 pediatric surgeons, who were experienced in hypospadias surgery. At the beginning of the
79 operation incision lines were outlined and marked (Figure 1). A tourniquet was employed.
80 Artificial erection test was performed, and in case of existence of a chordee the penile skin was
81 degloved and the dysplastic tissue was removed. A suitable-sized and non-toxic PVC catheter
82 (Feeding tube, Bıçakçılar Tıbbi Cihazlar San. ve Tic. AŞ, Turkey) was placed in the urethra. The
83 distance between the urethral meatus and the glans tip measured and recorded (Figure 2). The
84 meatus was circumscribed and the urethra proximal to the meatus was mobilized
85 circumferentially for a distance sufficient to allow the urethra to reach the tip of the glans without
86 tension. In presence of a laterally diverging corpus spongiosum, we extended our circumferential
87 dissection laterally in order to contain as much spongiosum as possible. Obviously, in some
88 patients having all the spongiosum in the incision borders was not manageable, thus some left
89 attached with the corpora cavernosa. The length of the urethral mobilization was measured and
90 recorded (Figure 3). If there was a thin and transparent urethra, we lengthened urethral
91 mobilization as this portion would be excised after repositioning and securing the urethra in the
92 glans wings. If the length of the thin portion exceeded 3-4 mm, we switched the technique not to
93 increase urethral mobilization length. Ventral glans was incised deeply into the corpora cavernosa
94 and the glans wings were mobilized laterally. Glanular bed was prepared and then the mobilized
95 urethra was placed in it (Figure 4). Dorsal lip of the urethra was sutured to the glans tip with four
96 interrupted 6/0 polydioxanone sutures (PDS II, Ethicon, UK). Glans wings were wrapped around
97 the urethra as in the normal configuration, and sutured with 2 layers of interrupted sub-epithelial

98 6/0 polydioxanone sutures. The deeper layer secured the urethra to the glanular tissue and the
99 superficial layer approximated the glans wings. Anterior lip of the urethra was secured to glans
100 with four interrupted sutures, being two on each side of the midline. The penile tourniquet, which
101 was used intermittently during dissection, was removed when the glans reconstruction was
102 completed. Circumcision was performed in all primary cases and the operation was terminated
103 (Figure 5). A compression dressing was applied.

104 Urethral catheter was left in place at least 3 days. If the catheter dislodged after the post-
105 operative 3rd day and the patient was able to urinate, no catheter was re-inserted. Otherwise, a
106 new urethral catheter was placed and kept until the post-operative 5th day. Usually, on the post-
107 operative 5th day the diversion was removed and the patient was discharged after voiding. All
108 patients were given oxybutynin 0.2 mg/kg daily in two doses to prevent bladder spasms,
109 trimetoprim 6 mg/kg daily in two doses; and allobarbital 60 mg/kg, adiphenine hydrochloride 50
110 mg/kg and paracetamol 30 mg/kg daily in four doses as long as the bladder was catheterized.

111 On the post-operative 15th day, urethral calibration was performed with 6-8 Fr catheters in
112 children aged up to 3 years and with 10 Fr catheters in older children. Patients were called for
113 office visits on the post-operative 6th month to evaluate the cosmetic appearance (Figure 6) and
114 functional results. Cosmesis was evaluated with a slit-like meatus at the tip of the glans and lack
115 of chordee, while function was evaluated with a good stream of urine.

116 Statistical analyses were performed with SPSS 13.0 (Statistical Software Package for
117 Social Sciences, SPSS Inc, Chicago, IL, USA) software system. The quantitative data was
118 expressed as mean \pm standard deviation and the comparison of the data according to the groups
119 was performed with Students t Test. The statistical significance was set at p less than 0.05 with a
120 confidence rate of 95 %.

121

122 **Results**

123
124 A consistent re-evaluation of the patients' medical records was possible by means of
125 electronic database of our hospital. There were no early complications such as bleeding,
126 hematoma or infection.

127 The mean age of the patients was of 32.76 ± 23.65 months. The mean age of the patients
128 in Group 1 was 21.54 ± 12.57 months and in Group 2 was 54.50 ± 14.05 months ($p < 0.05$) (Table
129 1). One patient, who was operated because of glanular hypospadias, was excluded from the study
130 as he was older (15 years old) than the age range of the study groups.

131 The mean distance required for carrying the urethral meatus to the glans tip was $5.74 \pm$
132 2.03 mm and the length of mobilized urethra was 17.06 ± 6.20 mm. The ratio of the length of
133 mobilized urethra to the distance required for carrying the urethral meatus to the glans tip was
134 3.02 ± 0.51 . When we considered these values according to age groups, we found that the
135 distance required for carrying the urethral meatus to the glans tip in Group 1 was 5.43 ± 2.03 mm
136 and in Group 2 was 6.90 ± 1.66 mm ($p = 0.031$); and the length of mobilized urethra in Group 1
137 was 16.18 ± 6.45 mm and in Group 2 was 20.30 ± 3.86 mm ($p = 0.018$) (Table 1). The ratios of the
138 lengths of the mobilized urethras to the distances between the urethral meatus and the glans tip in
139 Group 1 and Group 2 were 3.04 ± 0.57 vs. 2.97 ± 0.17 respectively ($p = 0.56$) (Table 1).

140 The mean operation time was 58.82 ± 22.87 minutes. Comparison of operation times in
141 Group 1 (60.94 ± 22.32 minutes) and Group 2 (51.00 ± 24.35 minutes) revealed that two groups
142 were comparable ($p = 0.26$) (Table 1). Usually, the penile tourniquet time was limited to 15
143 minutes but in rare occasions it was permitted to stay for twenty minutes.

144 The mean catheter stay period was 3.48 ± 1.45 days. The mean catheter stay periods in
145 Group 1 (3.35 ± 1.39 days) and in Group 2 (4.00 ± 1.63 days) were similar ($p = 0.27$) (Table 1).

146 The mean follow-up period was 33.21 ± 16.87 months. The mean follow-up period in
147 Group 1 (32.45 ± 18.21 months) and in Group 2 (36.00 ± 10.83 months) were comparable
148 ($p=0.44$) (Table 1).

149 Five patients admitted with reduction in urinary flow calibration in the post-operative
150 early period, and in 4 patients the problem was solved with gentle dilatations. One patient, who
151 had already undergone an unsuccessful sub-coronal hypospadias repair required meatotomy. In
152 one patient, the most distal one of the glans approximation sutures disrupted leading to a minor
153 detachment in the glans. Although, this condition was a handicap for cosmetic appearance no
154 functional abnormality occurred. Slit-like meatus at the tip of the glans was obtained in 41
155 patients, while round shape meatus was present in 6 patients. No urethra-cutaneous fistula,
156 retraction of the urethral meatus and recurrent chordee were observed.

157 **Discussion**

159 Urethral advancement for hypospadias repair was first introduced in 1898 by Beck.^[4,5]
160 Utilization of this procedure was not consistently successful because of high incidence of
161 postoperative chordee due to inadequate mobilization of the urethra.^[5] After that time, numerous
162 ingenious methods for urethral advancement were reported.^[2,3,5-7] Koff et al., modified and
163 favored the technique with satisfactory results.^[8] In 1999 Türken et al., reported successful results
164 in patients who were operated with limited urethral mobilization (LUM) and eccentric
165 circummeatal-based skin flap technique. This technique was based on the mobilization of the
166 urethra with an eccentric circummeatal-based skin flap and glanular reconstruction by
167 repositioning of the mobilized urethra in the glanular bed.^[2,7] Utilization of an eccentric
168 circummeatal-based skin flap integrated to the LUM technique was a preventive measure to
169 preserve the blood supply of the distal urethra.^[2,7]
170

171 Our technique does not comprise skin flap use; and instead meticulous mobilization of the
172 distal urethra is performed. It is known that there is a fine network between the urethral branch of
173 the internal pudendal artery and terminal branches of the dorsal penile artery which creates an
174 important vasculature for the urethra.^[9] Thus, the fear of devascularization due to urethral
175 mobilization seems to be unfounded.^[10] In the present series, 5 patients admitted with reduction
176 in urinary flow calibration in the post-operative early period, and the problem was solved with
177 only one gentle meatal dilatation in 4 patients. One patient, who had had a previous sub-coronal
178 hypospadias surgery experienced meatal stricture and undergone meatotomy. However, as four
179 patients did not require re-operation for meatal strictures, we believe that the condition might
180 have been because of mild ischemia in the area at greatest risk. Evidently, the dual blood supply
181 of the urethra prevented necrosis of the distal part, which would have caused a fibrotic stricture of
182 the newly created meatus.^[3,9] The meatal stricture seen in 1 patient might have been because of
183 inadequate excision of the former fibrotic tissue and ongoing fibrosis. Therefore, we agree with
184 Alkan et al., that true fibrotic strictures of the meatus do not occur following mobilization of the
185 distal urethra.² Besides, performance of V-Y or Ψ incisions of the glanular tissue, which were
186 reported to decrease the post-operative stenosis rate, may be incorporated in the technique for
187 obtaining wider orifices.^{11,12} Our stricture rate (2.1 %) seems to be comparable with the
188 previously reported similar series.^[2,6,13]

189 Nine patients in our series had previously undergone unsuccessful surgery for
190 hypospadias. Two of these patients had sub-coronal and 7 patients had glanular meatus prior to
191 our operation. With the use of LUM technique it was possible to carry these meatus' to the tip of
192 the glans. We believe that, utilization of this technique in secondary reconstructions seems to be
193 effective in achieving good cosmetic and functional results.^[2,6,10,14]

194 Many different techniques are used to correct the distal hypospadias, especially in types
195 confined to glanular and coronal region. The MAGPI technique, which was favored for these
196 cases, has sometimes difficulty in correction of the chordee.^[15,16] As reported before, the LUM
197 technique relieves glanular chordee by mobilizing the urethra into the glans.^[5-7] The technique of
198 chordee correction by mobilization of the distal urethra is simple and effective. Also,
199 unsatisfactory cosmesis with retraction of newly constructed urethral meatus related to MAGPI
200 repair is resolved with the use LUM technique.^[5,15,16]

201 In the present series, mean mobilized length of the urethra was 17.06 ± 6.20 mm, and the
202 distance necessary to carry the urethral meatus to the glans tip was 5.74 ± 2.03 mm. To have
203 more precise results we grouped our patients according to their ages. Although, mobilized length
204 of the urethra (16.18 ± 6.45 mm vs. 20.30 ± 3.86 mm, $p=0.018$) and the distance necessary to
205 carry the urethral meatus to the glans tip (5.43 ± 2.03 mm vs. 6.90 ± 1.66 mm, $p=0.031$) were
206 significantly greater in older boys compared to the youngsters, their ratios remained the same
207 (3.04 vs. 2.97 , $p=0.56$). Thus, our data revealed that a ratio of 2.9 to 3:1 would be adequate to
208 preclude chordee. Atala proposed that, a 4 to 5:1 ratio should have been achieved between the
209 mobilized length of the urethra and the initial distance from the meatus to the distal margin of the
210 glanular groove to prevent chordee in urethral mobilization.^[5] Interestingly, the data from the
211 present study reveal that, a shorter mobilization length can also provide secure urethra-glanular
212 anastomosis without chordee; and closely resembles the findings of Hammouda et al.,^[17] who
213 found out that a three fold urethral mobilization was sufficient.

214 Forty-one patients had slit like meatus at the tip of the glans. The rest of the patients had
215 round shape appearance of the meatus with acceptable cosmetic results. These patients were the
216 early cases of our series. We believe that, this condition was due to insufficiency in dissection
217 during mobilization of the urethra and inadequate preparation of the glanular bed as described

218 before.^[2,3,5] After those mild results, we reviewed our technique to achieve longer mobilization,
219 more widening of the glans and deeper dissection of the glanular groove.

220 The present study has two limitations due to certain technical aspects. Firstly, the use of
221 the LUM technique in proximal hypospadias is questionable. Natural elasticity of the urethra is
222 the main factor for using this technique and the continuing growth of the spongy urethra keeps
223 pace with the general growth of the child.^[3,5,10,14] The LUM repair in distal hypospadias offers
224 relatively risk-free opportunity to advance the urethral meatus to the glans tip without
225 constructing a neourethra, thus reducing the risk of fistula formation.^[6,10] On the other hand,
226 release of chordee in proximal shaft hypospadias results in an increase in the distance between
227 the urethral meatus and the glans, and the use of this procedure in greater distances may
228 apparently result in secondary chordee and even penile shortening.^[2,10] Thus, we can not
229 comment on this situation as we did not use the technique for proximal hypospadias repair, but in
230 such cases unsatisfactory results can be predicted.^[10]

231 The presence of a thin and transparent urethra proximal to the meatus is the second
232 limitation of the LUM technique. The use of this procedure in these cases necessitates high skill
233 and meticulous dissection in order not to injure the urethra.^[6] Besides, it is obvious that the thin
234 portion of the urethra would go to necrosis because of its poor vascularization. When a thin
235 urethra was present, we extended urethral mobilization length a bit more as we would excise this
236 portion after repositioning and securing the urethra in the glans wings. If the length of the thin
237 portion of the urethra exceeded 3-4 mm, especially in the sub-coronal hypospadias cases, we
238 switched to another technique in order not to increase the urethral mobilization length.

239 As a conclusion, although perhaps only useful in distal hypospadias repairs, the LUM
240 technique seems to be a good method with satisfactory cosmetic and functional results. A 2.9 to 3

241 fold urethral mobilization length is adequate to prevent chordee and achieve tension-free urethra-
242 glanular anastomosis.

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	Group 1 (n = 37)	Group 2 (n = 10)	p
Age (Mean ± SD) (months)	21.54 ± 12.57	54.50 ± 14.05	< 0.05 ^μ
Gap* (Mean ± SD) (mm)	5.43 ± 2.03	6.90 ± 1.66	0.031 ^μ
Urethral mobilization length (Mean ± SD) (mm)	16.18 ± 6.45	20.30 ± 3.86	0.018 ^μ
Gap / Urethral mobilization length (Mean ± SD)	3.04 ± 0.57	2.97 ± 0.17	0.56
Operation time (Mean ± SD) (minutes)	60.94 ± 22.32	51.00 ± 24.35	0.26
Catheter stay period (Mean ± SD) (days)	3.35 ± 1.39	4.00 ± 1.63	0.27
Follow-up time (Mean ± SD) (months)	32.45 ± 18.21	36.00 ± 10.83	0.44

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298 **Table 1:** The demographic features and statistical comparison of the study groups

299 GAP*: The distance necessary to carry the urethral meatus to the glans tip.

300 ^μ : p < 0.05, Student t test.

301 .

302 **Figure Labels**

303

304 **Figure 1:** Incision lines outlined and marked.

305 **Figure 2:** The distance between the urethral meatus and tip of the glans measured and
306 recorded.

307 **Figure 3:** The length of urethral mobilization measured and recorded.

308 **Figure 4:** Glanular bed prepared and mobilized urethra placed in.

309 **Figure 5:** Operation terminated.

310 **Figure 6:** Post-operative 6th month appearance with a good cosmetic result.

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