

Tape Blisters After Hip Surgery: Can They Be Eliminated Completely?

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ABSTRACT

It was recently reported that use of a perforated, stretchable cloth tape instead of silk tape reduced the incidence of postoperative blisters around the hip from 41% to 10%. The present prospective randomized study was conducted to determine whether use of spica bandage (vs the cloth tape) could further reduce or eliminate the incidence of these blisters. Patients were randomized to 2 treatment groups: perforated, stretchable cloth tape (Hypafix®; Smith & Nephew, Memphis, Tenn) and elastic spica bandage that was started at the lower thigh and was extended around the hip and abdomen. After surgery, cloth tape or spica bandage was applied over the postoperative dressing, with care taken not to produce skin tension. At the first dressing change, presence or absence of blisters was recorded, along with their number, size, location, and type. All subsequent dressing changes were done much as they were at surgery, using the assigned type of dressing. Presence or absence of blisters was recorded at each subsequent dressing change. Two hundred ninety-four patients (300 hips) were enrolled. Twenty-two (7.33%) of the 300 hips developed a blister. Risk for developing a blister was 10% with the cloth tape versus 4.67% with the elastic spica bandage ($P<.09$). Surgery type (arthroplasty vs open reduction and internal fixation [ORIF], $P<.03$) and surgery duration ($P<.05$) had more of an effect on postoperative blister formation than dressing type.

Adhesive injuries around surgical wounds remain a clinical problem. Tape blisters can be a source of increased postoperative morbidity and remain a significant quality assurance issue. Loss of the epidermis exposes the underlying dermis and its associated nerve endings, resulting in patient discomfort. Furthermore, superficial skin loss represents a localized area through which pathogens may enter and may increase the risk for a postoperative wound infection.

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Hypotheses have been suggested regarding development of tape blisters.^{1,2} Most point to creation of shear forces at the dermal-epidermal junction in association with compromised vascular supply to the dermis in the postoperative setting. It was recently reported that use of a perforated, stretchable cloth tape instead of silk tape reduced the incidence of postoperative blisters around the hip from 41% to 10%.³ We conducted the present prospective randomized study to determine if use of an elastic spica bandage (vs the perforated tape) could further reduce or even eliminate the incidence of these blisters. We hypothesized that elastic spica bandages would further reduce or even eliminate the incidence of blisters after hip surgery.

MATERIALS AND METHODS

Target Population

All patients who underwent surgery about the hip in our hospital system were considered eligible for inclusion in this study.

Procedure

After signing informed-consent forms approved by the Institutional Review Board at the hospital (study H10455-02), patients were randomized by computer-generated random number series into 2 treatment groups: perforated cloth tape with increased conformability (Hypafix®; Smith & Nephew, Memphis, Tenn) and elastic spica bandage.

At completion of surgery, the cloth tape or spica bandage was applied over the postoperative dressing as follows. The cloth tape was applied along the longitudinal axis of the limb with care not to create tensile forces. The spica bandage was started at the lower thigh and was extended around the hip and abdomen (Figure 1).

Patients were prospectively followed throughout their hospital stay and maintained a similar postoperative protocol. All patients received 48 hours of prophylactic antibiotics, were placed on thromboprophylaxis, and were mobilized out of bed on postoperative day 1 or 2.

The dressing was first changed on postoperative day 3, unless wound drainage or soilage necessitated changing the dressing earlier. At the first dressing change, presence or absence of tape blisters was recorded, along with their number, size, location, and type (blood or clear-fluid filled; blister roof intact or disrupted).

All subsequent dressing changes were done much as they were at surgery, using the assigned type of dressing. The reason for additional dressing changes was recorded, as well as total number of dressing changes for each patient. Presence or absence of tape blisters was recorded



Figure 1. Use of the elastic spica bandage after hip fracture surgery.

at each dressing change. All surgical wounds were visually inspected by one of the 2 senior authors (Dr. Koval, Dr. Egol). Blisters were treated daily with 1% silver sulfadiazine cream (Kendall; Mansfield, Mass) until reepithelialization occurred.

Demographic information collected during hospitalization included patient age, sex, race, smoking history, comorbidities, type of anesthesia, type of surgery, and reason for surgery.

Statistical Methods

Based on the results of a previous study, it was hypothesized that the blister rate would be 10% with the cloth tape.³ A 1% incidence of tape blisters was previously reported with elastic spica bandages.⁴ Power estimates for observing statistically significant differences between tape blister rates of 10% versus 1% and 2% with 150 hips in each group were estimated at 93.2 and 83.4, respectively. Loss to follow-up was handled as a failure (ie, tape blister formation), and any treatment crossover was handled with an intent-to-treat approach.

Before assessing for treatment efficacy, demographic and clinical characteristics were compared between patients randomized to the cloth tape and spica bandage groups to assess for differences in baseline group characteristics that may have influenced the risk for blister development separate from that associated with type of dressing used.

The principal analysis of this study was a comparison of risk for development of blisters among patients randomized to receive cloth tape and those randomized to receive spica bandage. Adjusted and unadjusted relative risks (RRs) for blisters, along with 95% confidence intervals (CIs), were computed with SAS 9.1 (Windows XP). Adjusted and unadjusted RRs for blister development and CIs were estimated with the GENMOD procedure, in which outcome distribution was specified as Poisson and link function as log, with adjustments based on personal and health demographics as well as surgical factors.

RESULTS

Two hundred ninety-four patients (300 hips) were enrolled between July 2002 and December 2003. The demographic and surgical procedure characteristics of these patients are summarized in Table I. Mean age was 67.3 years (SD, 19.9 years; median, 74 years; range, 14-100 years). Approximately 69% of the patients were female, 68% were white, 73% reported no smoking history, and 13% reported no associated medical comorbidities. Sixty-four percent of patients had surgery secondary to fracture (36% had surgery secondary to arthritis); 52% of patients underwent arthroplasty (48% underwent fracture fixation); 60% of surgeries were performed under general anesthesia (40% under regional anesthesia); and 66% of the procedures were performed in less than 2 hours. There was no loss to follow-up or crossover between treatment arms.

There were no statistically distinguishable differences in distribution of any of the personal or health demographics between patients randomized to cloth tape and those randomized to spica bandage: sex ($P < .23$), race ($P < .55$), smoking history ($P < .08$), number of comorbidities ($P < .63$), age (68.7 ± 20.2 years for the cloth tape group vs 65.8 ± 19.5 years for the spica bandage group; $F_{1,292} = 1.61$, $P < .21$). However, patients treated with spica bandage were significantly more likely than patients treated with cloth tape to be in the fracture group (73.8% vs 53.4%; $P < .0001$), to be treated with arthroplasty (60.1% vs 43.2%; $P < .004$), and to have had surgery performed in less than 2 hours (75.7% vs 57.2%; $P < .002$). The 2 groups did not differ in type of anesthesia ($P < .46$).

Tape blister outcome was recorded for all 300 hips. The first dressing change occurred on postoperative day 3 in 91% of cases. Rates of dressing changes done before day 3 were not significantly different between the 2 dressing types (8% for spica bandage group vs 10% for cloth tape group; $P < .55$).

Overall, 22 (7.33%) of the 300 hips developed a blister. Of the 22 hips that developed blisters, 59% were observed at the first dressing change. Of the 22 hips, 12 had a single blister, 4 had 2 blisters, 5 had 3 blisters, and 1 had 4 blisters. Blister size ranged from less than 1 cm to 3 cm in diameter. Twenty-one of the 22 blisters were clear; 1 blister less than 1 cm in diameter was blood-filled. No patient developed a postoperative wound infection during hospitalization.

RRs associated with the individual demographic, health, and surgical variables are summarized in Table II. Risks for developing a blister were 10% for the cloth tape group and 4.67% for the spica bandage group. Although the risk for blisters was 2.14 times higher with cloth tape than for spica bandage, the 95% CI of .90-5.11 showed that this effect did not reach statistical significance ($P < .09$). Similarly, though RR for blisters was higher for females (1.60), for whites versus blacks (2.89), and for smokers (1.29), none of these RRs was reliability different from 1.00. However, patients undergoing arthroplasty were 2.85 times more likely than

Table I. Patient Characteristics, by Treatment Group (N = 294 Patients)

	Elastic Spica Bandage (%) (N = 148)	Cloth Tape (%) (N = 146)	Row Total	χ^2	df	P
Patients	50.3	49.7	294			
Sex						
Male	28.4	34.9	93	1.45	1	.23
Female	71.6	65.1	201			
Race						
White	66.9	68.5	199	2.13	3	.55
Black	14.2	11.6	38			
Hispanic	12.8	16.4	43			
Other*	6.1	3.4	14			
Smoking history						
Never smoked	73.8	76.9	214	5.11	2	.08
Current smoker	12.1	4.9	24			
Past smoker	14.2	18.2	46			
Missing†	4.7	2.11	10			
Comorbidity						
0	12.2	14.4	39	0.24	1	.63
1+	84.5	84.3	248			
Missing†	3.4	1.4	7			
Reason for surgery						
Fracture	75.0	53.4	189	14.90	1	.0001
Reconstruction	25.0	46.6	105			
Surgery type						
ORIF‡	39.9	56.8	142	8.49	1	.004
Arthroplasty	60.1	43.2	152			
Surgery duration (h)						
0-1	13.5	6.9	30	15.17	3	.002
1-2	62.2	49.3	164			
2-3	30.0	32.8	79			
3-4§	3.4	9.6	19			
5+§	0	1.4	2			
Anesthesia type						
General	58.1	62.3	177	0.55	1	.46
Regional	41.9	37.7	117			

*14 (10 from Asia, 3 from India, 1 from Pakistan). †Category not included in analysis. ‡Open reduction and internal fixation. §Categories combined in analysis.

those undergoing open reduction and internal fixation (ORIF) to develop blisters ($P < .03$), and patients whose procedures took 2 hours or more were 2.4 times more likely to develop blisters than patients whose procedures were performed in less than 2 hours ($P < .05$).

As preliminary evaluation for initial differences in the cloth tape and spica bandage groups showed some differences, especially with regard to surgical factors, RRs were adjusted for personal, health, and surgical factors to evaluate the extent that these group differences might have biased the results. RRs for blisters with regard to type of dressing, type of surgery, and surgery duration adjusted for individual factors and for multiple factors are summarized in Table III. In general, adjusted RRs did not change the interpretation of results. For dressing type, in all cases, blister risk remained higher for cloth tape than spica bandage, but no RRs were reliability different from 1.0. For surgical procedure, arthroplasty (vs ORIF) remained a significantly higher risk factor for blisters, except when controlling for dressing type, where the RR dropped to 2.56 and the 95% CI was .99-6.63. However, when adjusted for the full set of factors, arthroplasty (vs ORIF) was at higher risk for blisters (RR = 2.87, $P < .02$). Last, several adjustment variables mediated the

risk for surgery duration for development of blisters, and, though RR for blisters remained relatively high (2.29) when controlling for all other factors, this RR was not reliably different from 1.0 ($P < .13$).

Although not specifically recorded on the data sheets, use of spica bandages was associated with a higher incidence of patient dissatisfaction (eg, regarding abdominal and thigh constriction secondary to circumferential bandage; fecal and urinary soiling). As noted earlier, however, incidence of early dressing changes, which might be associated with these complaints, was actually higher in the cloth tape group (10%, 15/150) than in the spica bandage group (8%, 12/150), though not statistically different ($P < .55$).

On the basis of significant surgery type and surgery duration effects, a subgroups analysis was performed for blister differences across cloth tape and spica bandage conditions within the 4 groups defined by surgery type and surgery duration. The general pattern of results was consistent with the elevated RRs for arthroplasty versus ORIF and for surgeries lasting 2 hours or more versus shorter surgeries (Figure 2). However, it was only in arthroplasty procedures lasting less than 2 hours that the spica bandage group had a significantly lower RR, or a protective effect for blisters, compared with the cloth tape group (RR, .87; 95% CI, .75-.99).

Table II. Estimated Relative Risk for Developing a Blister, by Patient Personal, Surgical, and Health Characteristics

Predictor	Blister				Contrast (X>Reference)	Relative Risk			P
	Yes	No	Total	Risk		RR	95% CI		
							Lower	Upper	
Hip wounds	22	278	300	7.33					
Sex									
Male (M)	5	91	96	5.21	F>M	1.60	.61	4.21	.35
Female (F)	17	187	204	8.33					
Race									
White (W)	16	188	204	7.84	W>B	2.89	.38	21.84	.31
Black (B)	1	38	39	2.56	H>W	1.16	.38	3.99	.81
Hispanic (H)	3	40	43	6.98	W>BHO	1.23	.46	3.24	.69
Other (O)	2	12	14	14.29					
Age group (y)									
14-45 (A)	4	43	47	8.51	A>C	1.76	.39	7.85	.46
46-65 (B)	6	57	63	9.52	B>C	1.97	.49	7.86	.34
66-75 (C)	3	59	62	4.84	D>C	1.45	.39	5.36	.58
76-100 (D)	9	119	128	7.03					
Comorbidity									
1+ (Y)	19	234	253	7.51	Y>N	1.00	.29	3.38	.99
0 (N)	3	37	40	7.50					
Missing*	0	7	7	0.00					
Smoking status									
Smoker (S)	2	22	24	8.33	S>NS	1.29	.29	5.71	.74
Past smoker (PS)	5	43	48	10.42					
Never smoked (NS)	14	204	218	6.42	PS>NS	1.62	.58	4.50	.36
Missing*	1	9	10	10.00					
Reason for surgery									
Fracture repair (F)	10	183	193	5.18	R>F	2.16	.94	5.01	.08
Reconstruction (R)	12	95	107	11.21					
Surgery type									
Arthroplasty (A)	16	129	145	11.03	A>O	2.85	1.12	7.28	.03
ORIF† (O)	6	149	155	3.87					
Surgery duration (h)									
2+ (L)	12	88	100	12.00	L>S	2.40	1.04	5.55	.05
0-2 (S)	10	190	200	5.00					
Anesthesia type									
General (G)	13	168	181	7.18	R>G	1.05	.45	2.46	.91
Regional (R)	9	110	119	7.56					
Dressing type									
Cloth tape (C)	15	135	150	10.00	C>S	2.14	.90	5.11	.09
Spica bandage (S)	7	143	150	4.67					

*Category not included in analysis. †Open reduction and internal fixation.

DISCUSSION

In this study, incidence of blisters around the hip was reduced from 10% to 4.67% by switching from a stretchable cloth tape to an elastic spica bandage. This was a further improvement on results from an earlier study at our institution, in which incidence of tape blisters was reduced by changing from nonstretchable tape (41% incidence) to stretchable cloth tape (10%).³ Although not statistically significant, spica bandage use represented a risk reduction of 2.14. To reliably detect a difference between 10% and 4.67% with a power of .80 would require a sample of 375 hips in each condition, which indicates that this study was underpowered and highlights the difficulty in demonstrating statistically significant results with low-incidence events.

These results were similar to those reported by Hahn and colleagues,⁴ who retrospectively compared tape use (89 patients) and elastic spica bandage use (273 patients) after hip surgery. Although type of tape used was not mentioned, the authors reported that blisters developed for 15% of patients with taped dressings versus only 1% of patients with com-

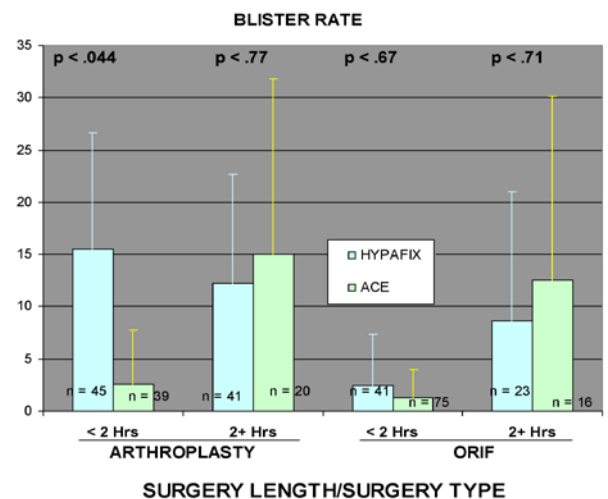


Figure 2. Blister formation rates across the 2 dressing types (cloth tape, spica bandage) within the 4 groups defined by surgery type and surgery duration. ORIF indicates open reduction and internal fixation.

Table III. Estimated Adjusted Relative Risk for Developing a Blister, by Patient Personal, Surgical, and Health Characteristics

Predictor	Adjusted For	Contrast*	Relative Risk			P
			RR	95% CI		
				Lower	Upper	
Dressing type	None	C>S	2.14	.90	5.11	.09
	Sex		2.21	.90	5.43	.09
	Race		2.16	.88	5.34	.10
	Age		2.14	.87	5.25	.10
	Surgery type		1.82	.74	4.53	.20
	Surgery duration		1.84	.74	4.59	.20
	Anesthesia type		2.14	.87	5.27	.10
	All		1.73	.69	4.45	.25
Surgery type	None	A>O	2.85	1.15	7.08	.03
	Dressing type		2.56	.99	6.63	.052
	Sex		2.81	1.10	7.19	.031
	Race		3.21	1.21	8.51	.02
	Age		2.84	1.11	7.29	.03
	Surgery duration		2.50	.96	6.48	.06
	Anesthesia type		2.98	1.14	7.76	.026
	All		2.87	1.19	6.97	.02
Surgery duration	None	L>S	2.40	1.04	5.55	.041
	Dressing type		2.12	.87	5.15	.10
	Sex		2.47	1.10	5.51	.03
	Race		2.58	1.13	5.88	.03
	Age		2.58	.97	6.85	.06
	Surgery type		2.04	.87	4.80	.11
	Anesthesia type		2.40	1.07	5.35	.04
	All		2.29	.80	6.56	.13

*C>S indicates risk of tape blisters with cloth tape (C) versus spica bandage (S); A>O, risk of tape blisters with arthroplasty (A) versus open reduction and internal fixation (O); L>S, risk of tape blisters with long (2+ hours) surgical time (L) versus short (0-2 hours) surgical time (S).

pressive spica bandages. Thrombophlebitis incidence was not higher with use of spica bandages. Similarly, in our study, no patient developed a clinically apparent deep vein thrombosis.

In this study, type of surgery (arthroplasty vs ORIF) and, to a lesser extent, surgery duration had more of an effect on postoperative blister formation than dressing type did. Patients who underwent arthroplasty and had surgery lasting 2 hours or more were more likely to develop a postoperative blister around the hip than were patients who underwent fracture fixation and had shorter surgery. It is possible that more extensive surgery (arthroplasty) and longer surgery resulted in more soft-tissue swelling, thus increasing the risk for skin shearing and blister formation.⁵

Complete elimination of blister formation after hip surgery, even with spica bandages, was not achieved, perhaps partially because of intraoperative use of adhesive drapes. All patients in this study had some form of intraoperative adhesive drape as an isolation barrier (eg, IobanTM; 3M Health Care, St. Paul, Minn) during arthroplasty, or an adhesive isolation screen during fracture fixation. Removal of these adhesive drapes may cause a shear-type injury to the skin around the hip and may have contributed to blister formation with use of spica bandages.

Although spica bandages were associated with a higher incidence of patient dissatisfaction (eg, that regarding abdominal and thigh constriction secondary to circumferential bandage; fecal and urinary soiling), these complaints did not result in more dressing changes made before the planned change on postoperative day 3, which suggests the value in correlating patient self-reports with clinical outcomes.

In conclusion, though not statistically significant, incidence of blisters around the hip was reduced from 10% to 4.67% by switching from stretchable cloth tape to an elastic spica bandage. After adjustments for demographic, health, and surgical factors, larger risks for blister formation were associated with arthroplasty (vs ORIF), and, somewhat surprisingly, spica bandages (vs cloth tape) resulted in significantly less blister formation in arthroplasty procedures lasting less than 2 hours.

AUTHORS' DISCLOSURE STATEMENT AND ACKNOWLEDGMENTS

The authors report no actual or potential conflict of interest in relation to this article. This study was conducted at Hospital for Joint Diseases, New York, New York, and Jamaica Hospital Medical Center, New York, New York.

REFERENCES

1. Comaish JS. Epidermal fatigue as a cause of friction blisters. *Lancet*. 1973;1:81-83.
2. Milne CT, Barrere CCP, McLaughlin T, Moore A. Surgical hip dressings: a comparison of taping methods. *Orthop Nurs*. 1999;18:37-42.
3. Koval KJ, Egol KA, Polatsch DB, Baskies MA, Homman JP, Hiebert R. Tape blisters following hip surgery: a prospective randomized study of two types of tape. *J Bone Joint Surg Am*. 2003;85:1884-1887.
4. Hahn GJ, Grant D, Bartke C, McCartin J, Carn RM. Wound complications after hip surgery using a tapeless compressive support. *Orthop Nurs*. 1999;18:43-49.
5. Fox E, Schakenbach L, Abrahams E. Tape blisters and possible etiologies following hip surgery. Poster presented at: Annual Congress of the National Association of Orthopaedic Nurses; 1995; Minneapolis, Minn.