

Wound Complications Following Diagnostic Skin Biopsies in Dermatology Inpatients

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Objectives: To prospectively determine the wound complication rate for dermatology inpatients undergoing diagnostic skin biopsies during their admission and to determine significant host and procedural risk factors.

Design: Prospective assessment, by a single observer, of 100 postdiagnostic skin biopsy wounds in dermatology inpatients. The following data were recorded for each patient: age and sex, presence of comorbidities, smoking status, dermatologic diagnosis, use of immunosuppressive or antibiotic therapy, place of biopsy (whether in the operation theater or in the ward), grade of physician performing biopsy, biopsy site on the body, type of biopsy (whether elliptical incision, punch, shave, or curettage), and wound closure technique.

Main Outcome Measure: Wounds were designated as having had no complication or as being complicated by infection, dehiscence, and/or hematoma.

Setting: A dedicated dermatology inpatient ward in a university teaching hospital.

Results: Wound complications occurred in 29 (29%) biopsies, 27 (93%) of which were the result of wound infection. Complications occurred significantly more frequently when biopsies were performed below the waist compared with above the waist ($P < .02$), in the ward compared with the outpatient operating theater ($P < .001$), in smokers compared with nonsmokers ($P < .001$), and in those taking corticosteroids compared with those who were not ($P < .001$). In addition, elliptical incisional biopsies developed complications more frequently when subcutaneous sutures were not used compared with when they had been used ($P < .001$).

Conclusions: This study has demonstrated a high rate of wound complications after diagnostic dermatologic surgery on dermatology inpatients with significant host and procedural risk factors. These findings are relevant for other centers with inpatient units where diagnostic biopsies are performed.

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DERMATOLOGISTS REGULARLY perform diagnostic skin biopsies on outpatients, inpatients, and day-case patients.¹⁻⁹ Multiple risk factors can influence the risk of postoperative wound complications.⁵⁻⁹ Although published information exists regarding the complications of skin surgery in an outpatient setting,⁵⁻⁹ there is no information describing the complications of diagnostic skin biopsies for an inpatient population. In our center, it was noted that wound infection was a common complication among inpatients undergoing skin biopsy as part of their diagnostic workup. The aim of the present study was to prospectively determine the wound complication rate for dermatology inpatients undergoing diagnostic skin biopsies during their admission, and to determine significant host and procedural risk factors.

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METHODS

The study protocol was reviewed and approved by an independent review board and all study participants gave oral consent.

WARD AND STUDY POPULATION

The prospective study took place in the dermatology ward of the Newcastle-upon-Tyne Hospitals National Health Service Trust between January 15 and September 15, 2006. The ward is a 16-bed unit for adult patients with dermatologic disease, with dedicated cubicles for those colonized with methicillin-resistant *Staphylococcus aureus* (MRSA). Patients are admitted either electively or on an emergency basis after consultation with a dermatologist.

SURVEILLANCE

All dermatology inpatients who underwent diagnostic incisional and excisional skin biopsies during their hospital admission were prospectively assessed for postoperative wound

complications. Diagnostic skin biopsies surveyed included elliptical incisions, punch incisions, shave biopsies, or curettage and cautery.

The following data were recorded by the operating physician for each patient: age and sex, presence of comorbidities (diabetes mellitus, MRSA, leg edema, obesity), smoking status, dermatologic diagnosis, and the use of immunosuppressive or antibiotic therapy at the time of the biopsy.

The following procedural data were also recorded: place of biopsy (whether in an examination room in the dermatology ward or in a dedicated outpatient operation theater), grade of physician performing biopsy (whether senior house officer, specialist registrar, or consultant), biopsy site on the body, type of biopsy (whether elliptical incision, punch, shave, or curettage), wound closure technique, and whether senior advice was given to the operating physician (on the type or site of biopsy or on wound closure).

One of us (S.W.) inspected and assessed each postoperative wound every 3 days until hospital discharge. Wounds were designated as having had either no complications or complications classified as wound infection (manifested by erythema, edema, warmth, and discharge of pus), wound dehiscence, and/or hematoma.

Medical notes, microbiology reports, temperature, and treatment charts were also reviewed. At discharge, the dermatologist recorded whether the wound site had reepithelialized or required ongoing treatment in the community. Wounds were not routinely surveyed after discharge.

STATISTICAL ANALYSIS

A binomial test of 2 proportions was used to determine if independent variables were significantly associated with the development of wound complication. A multivariate analysis using binomial logistic regression was performed (using SPSS software version 12 [SPSS Inc, Chicago, Illinois]). All variables were fitted into a multivariate model and kept if they remained significantly associated with wound complication after adjusting for other factors in the model.

RESULTS

A total of 301 patients were admitted to the dermatology ward during the 8-month survey period and 75 of these patients (40 men and 35 women; median age, 62 years; range, 18-94 years) had a total of 100 diagnostic biopsies.

Twenty of the 100 diagnostic biopsies were performed on patients with diabetes, 22 on individuals colonized with MRSA, 5 on those with leg edema, 4 on obese individuals, 33 on smokers, and 19 on patients taking prednisolone at a dosage of more than 0.5 mg/kg/d. Twelve biopsies were performed on patients taking oral floxacin or amoxicillin, which had been prescribed by their general practitioner before admission.

The dermatologic diagnosis was defined at the end of a patient's admission. Twenty-eight biopsies were performed on patients with autoimmune blistering diseases, such as bullous pemphigoid (n=23), pemphigus (n=3), and linear IgA disease (n=2). The remainder of the biopsies were performed for nonblistering conditions, such as eczema (n=29), psoriasis (n=25), leukocytoclastic vasculitis (n=9), drug-induced eruptions (n=5), skin cancers (n=3), and lymphoma (n=1).

Biopsies were performed in a dedicated examination room in the dermatology ward using a portable biopsy kit in 34 cases and in 1 of 3 dedicated outpatient operation theaters in the remaining 66 cases. The grade of physician carrying out the diagnostic biopsy included a senior house officer in the first month of dermatology training (23 biopsies), a senior house officer in the second to fourth month of dermatology training (55 biopsies), a specialist registrar with more than 24 months' experience (18 biopsies), and a consultant (4 biopsies). Of the 100 biopsies, 75 were performed on sites above the waist (57 on the arm, 10 on the back, 5 on the chest, and 3 on the head and neck) and 25 were performed on sites below the waist (21 on the leg and 4 on the groin and genitals).

Fifty-six procedures were punch biopsies, 40 were elliptical incisions, 3 were shave biopsies, and 1 was a curettage. All punch and elliptical incisional biopsies were closed with interrupted surface sutures, but subcutaneous sutures were only used in 13 (33%) of the elliptical biopsies. The operating physicians indicated that senior advice, on either the type or site of biopsy or wound closure technique, was given in 35 of 90 cases. In 10 cases, these data were missing.

POSTBIOPSY WOUND COMPLICATIONS

Wound complications occurred in 29 of the 100 diagnostic biopsies performed. Twenty-two wounds demonstrated clinical signs of infection alone, 2 of dehiscence alone, and 5 had signs of both infection and dehiscence. No wounds were complicated by hematoma.

In the 27 cases in which infection was clinically evident, positive bacterial isolates from wound swabs were isolated in 24 (*S aureus* in 15, *Streptococcus* species in 4, and MRSA in 5 cases). Of the 5 patients with MRSA wound infections, 4 were colonized with MRSA on admission. Twelve biopsies (6 ellipses and 6 punches) were performed on patients already taking antibiotics, of which half subsequently developed wound infections.

All 27 patients with wound infections were treated with topical and oral antibiotics according to the sensitivities from wound swabs. Consequently, 2 developed abnormal liver function, 2 developed noninfectious diarrhea; all 4 patients experienced a delay in their discharge. At discharge, 4 of 29 wounds that had developed a complication after the procedure still required treatment in the community.

The **Table** records the univariate analysis findings on the incidence and characteristics associated with all wound complications. Wound complications occurred significantly more frequently when biopsies were performed below the waist compared with above the waist (48% vs 23%, 95% confidence interval [CI] for difference, 36%-47%; $P < .02$); in the ward compared with the outpatient operation theater (53% vs 17%, 95% CI for difference, 17%-55%; $P < .001$); in smokers compared with nonsmokers (64% vs 12%, 95% CI for difference, 34%-70%; $P < .001$); and in those taking corticosteroids compared with those who were not (63% vs 21%, 95% CI for difference, 19%-66%; $P < .001$). In addition, elliptical incisional biopsies developed complications more fre-

Table. Univariate Analysis of Characteristics Associated With Wound Complications

Biopsy Sample	No. of Wound Complications (n = 29)	No. of Biopsies (n= 100)	Sample Proportions	95% Confidence Interval for Difference	P Value	
					Test for Difference	Fisher Exact Test (for Small Samples)
Biopsy site						
Below waist	12	25	0.48	0.04 to 0.47	.02	NA
Above waist	17	75	0.23			
Biopsy location						
In ward	18	34	0.53	0.17 to 0.55	<.001	NA
In outpatient operation theater	11	66	0.17			
Grade of physician						
Senior house officer (1st month of training)	11	23	0.48	-0.03 to 0.44	.09	NA
Senior house officer (2nd to 4th month of training)	15	55	0.27			
Senior house officer (all)	26	78	0.33	0.02 to 0.37	.03	.11
Specialist registrar and consultant	3	22	0.14			
Elliptical biopsy						
Without subcutaneous sutures	19	27	0.70	0.29 to 0.81	<.001	.002
With subcutaneous sutures	2	13	0.15			
Smoking status						
Smoker	21	33	0.64	0.34 to 0.70	<.001	NA
Nonsmoker	8	67	0.12			
Corticosteroid therapy						
Yes	12	19	0.63	0.19 to 0.66	<.001	NA
No	17	81	0.21			
Advice to operator						
No senior advice	19	55	0.35	-0.10 to 0.28	.37	NA
Senior advice	9	35	0.26			
Age, y						
≥60	25	80	0.31	-0.09 to 0.32	.28	.42
<60	4	20	0.20			
MRSA						
Positive	5	22	0.23	-0.28 to 0.12	.44	NA
Negative	4	78	0.31			
Diabetes mellitus						
Yes	3	20	0.15	-0.36 to 0.01	.07	.17
No	26	80	0.33			
Blistering disease						
Yes	11	28	0.39	-0.07 to 0.35	.20	NA
No	18	72	0.25			
Obese						
Yes	2	4	0.50	-0.28 to 0.72	.39	.58
No	27	96	0.28			
Antibiotic therapy						
Yes	6	12	0.50	-0.06 to 0.54	.12	NA
No	23	88	0.26			
Sex						
Male	15	45	0.33	-0.10 to 0.26	.39	NA
Female	14	55	0.26			
Leg edema						
Present	1	5	0.20	-0.46 to 0.27	.61	NA
Absent	28	95	0.30			

Abbreviations: MRSA, methicillin-resistant *Staphylococcus aureus*; NA, not available.

quently when subcutaneous sutures were not used compared with when they had been used (70% vs 15%, 95% CI for difference, 29%-81%; $P < .001$). Biopsies performed by senior house officers developed wound complications more frequently than those performed by specialist registrars and consultants (33% vs 14%, 95% CI for difference, 19%-37%) but the Fisher exact test did not show this difference to be statistically significant ($P = .11$).

No statistically significant correlations were demonstrated between wound complication and the age or sex of the patient, comorbidities (ie, MRSA, diabetes, leg edema, obesity) or dermatologic diagnosis. Similarly, no links were established between complications occurring and the provision of senior advice or the use of antibiotics.

Multivariate analysis by logistic regression did not demonstrate any single variable that was a significant risk fac-

tor for wound complications. This is likely to be explained by the low number of trial events (n=29) and the large number of variables being investigated.

COMMENT

To our knowledge, this is the first study describing the incidence and risk factors for wound complications after diagnostic skin biopsies in a dermatology inpatient population.

We have shown that 29 (29%) diagnostic biopsies performed on inpatients resulted in a postoperative complication, 27 (93%) of which were due to wound infection. All the infections resulted in the need for antibiotics and their use led to a delay in discharge in 4 (15%) treated patients.

Univariate analysis demonstrated that cigarette smoking and the use of corticosteroids appeared to be the most significant *host* risk factors contributing to the development of wound complications. The most significant *procedural* risk factors for wound complication were biopsy sites below the waist, performing the biopsy in the ward rather than in the operation theater, and not using subcutaneous sutures after elliptical procedures.

Logistic regression analysis showed no single significant risk factor, possibly because only 29 wound complications were identified. A larger study including more complications might have increased the power of the analysis.

Data were not collected on the duration of the biopsy procedure or on the use of antiplatelet or anticoagulant therapy; these factors may have also been relevant to the development of wound complications.⁶

Smoking has been shown to be an important risk factor for wound complications after mastectomy,¹⁰ abdominoplasty,¹¹ and full-thickness skin grafts,¹² with heavy smokers being most at risk. Nicotine in cigarette smoke is a vasoconstrictor that causes tissue ischemia and impairs healing of injured tissue.¹³ Amici et al⁶ noted a significant association between immunosuppressants and wound complications after excisional dermatologic surgery, but did not specify which immunosuppressant drugs were involved.

Our study investigated wound complications solely associated with diagnostic skin biopsies. Previous authors have concentrated predominantly on the complications of excisional surgery (eg, for melanomas and nonmelanoma skin cancers) performed in an outpatient department setting.^{5,7-9,14} Dermatology inpatients differ significantly from outpatients in that inpatients are more likely to have widespread skin disease possibly colonized with *S aureus* to be systemically unwell, and to require intensive topical therapy and observation.² It is, therefore, not surprising that the rate of infectious complications in these studies of excisional surgery is far lower than in our present study.⁵ The preoperative state of the skin is clearly important. Weatherhead and Lawrence⁸ previously demonstrated (in a prospective case-control study of day-case patients) that 17% developed wound infection after excisional surgery when the overlying skin was ulcerated before surgery compared with 4% when the skin was intact.

Dettenkofer et al¹⁵ surveyed nosocomial infections in dermatology inpatients. Although their study did not describe any inpatients having diagnostic procedures, 7.6% of the inpatients who underwent basal cell carcinoma excision (in an operation theater setting) developed a wound infection. In the present study, 17% of inpatients (11 of 66) developed a wound infection when the biopsy was performed in an outpatient theater setting compared with 53% of inpatients (18 of 34) who had their biopsies in the ward.

There is still no universal consensus regarding recommendations for antibiotic prophylaxis to prevent wound infection in dermatologic surgery.¹⁶ In our study, 50% of procedures (6 of 12) performed with the administration of penicillin were still complicated with clinical and microbiologic evidence of infection. This suggests that the use of antibiotics was not fully effective in preventing wound infection.

Dermatologists aim to provide high-quality care for their patients, which includes the ability to perform diagnostic skin biopsies with minimal complications.¹⁷ Consequently, our findings have altered diagnostic biopsy practices in our own department. We now recommend that diagnostic biopsies on inpatients be performed on sites above the waist and in an outpatient department wherever possible. Smokers and those taking oral corticosteroids should be warned about an increased risk of postbiopsy complications. Consideration for the use of subcutaneous sutures in wound closure is important.

CONCLUSIONS

Our study has demonstrated a high rate of wound complications after diagnostic dermatologic surgery performed on inpatients with significant host and procedural risk factors. These findings may be relevant for other regional centers with inpatient units in which diagnostic biopsies are frequently performed by junior physicians. Further larger studies will be necessary to confirm these results and establish local (and possibly even national) guidelines regarding diagnostic biopsies in dermatology inpatients.

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Archives Web Quiz Winner

Congratulations to the winner of our July quiz, Johann E. Gudjonsson, MD, PhD, Department of Dermatology, University of Michigan, Ann Arbor. The correct answer to our July challenge was *verruciform xanthoma*. For a complete discussion of this case, see the Off-Center Fold section in the August *Archives* (Borer M, Smith J, White B, Sheehan D. A scaly plaque on the scalp. *Arch Dermatol*. 2007;143[8]:1067-1072).

Be sure to visit the *Archives of Dermatology* Web site (<http://www.archdermatol.com>) to try your hand at the interactive quiz. We invite visitors to make a diagnosis based on selected information from a case report or other feature scheduled to be published in the following month's print edition of the *Archives*. The first visitor to e-mail our Web editors with the correct answer will be recognized in the print journal and on our Web site and will also receive a free copy of *The Art of JAMA II*.