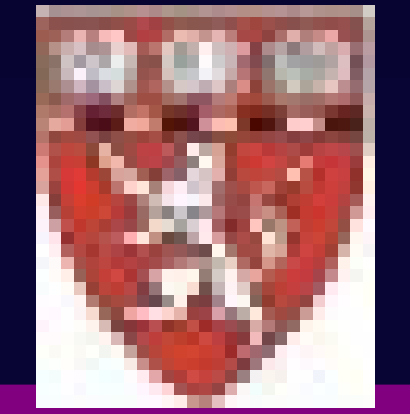


Shielding of the Hip Prosthesis During Radiation Therapy for Heterotopic Ossification is Associated with Increased Failure of Prophylaxis

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Introduction

Background: Radiation therapy (RT) is frequently administered to prevent heterotopic ossification (HO) after total hip arthroplasty (THA). The prosthetic hip components are often shielded given concern that RT may increase the risk of non-union with the prosthesis. We hypothesized that shielding compromises the efficacy of RT. The risks of HO after RT according to shielding status and prosthesis failure rates were examined.

Purpose:

- To examine the risk of HO after RT prophylaxis with and without shielding of the prosthetic hip components.
- To assess the risk of prosthetic hip failure with and without shielding.

Methods

This is a retrospective analysis of patients receiving RT to prevent HO development surrounding a prosthetic hip at the Brigham and Women's Hospital between 6/1994 and 2/2004.

- The Brooker grading system was used to assess HO and two independent reviewers scored all films.
- Baseline HO was determined with a plain film performed within 14 days after surgery and HO outcomes were determined by a follow-up plain film taken more than 4 months after surgery.
- The simulation film was used to assess shielding status. If more than 1/3 of the acetabulum was shielded or if any portion of the femur proximal to a line drawn from the distal greater trochanter to the distal lesser trochanter was shielded, then shielding was scored as present.
- Univariate and multivariate logistic regression were used to assess the relationships of all variables to failure of RT prophylaxis.

Table 1. Patient characteristics (N=101) (no statistically significant differences between groups).

| Characteristic | Shielded (N = 44) | Unshielded (N = 40) |
|---------------------------------------|-------------------|---------------------|
| Male; N (%) | 33 (75) | 29 (73) |
| Age, years; Mean (SD) | 63 (13) | 61.3 (12) |
| History of HO; N (%) | 37 (84) | 32 (80) |
| Follow-up, months; Mean (SD) | 31 (25) | 30 (23) |
| Surgery | | |
| THA; N (%) | 44 (100) | 37 (93) |
| Excision of HO after prior THA; N (%) | 0 (0) | 3 (8) |
| Revision THA for infection | 7 (16) | 3 (8) |
| RT timing | | |
| Preop RT, N (%) | 10 (23) | 17 (43) |
| Hours preop, Mean (SD) | 5.2 (1.5) | 4.4 (2.6) |
| Postop RT, N (%) | 34 (77) | 23 (58) |
| Hours postop; Mean (SD) | 45 (20) | 40 (16) |
| Dose, cGy; Median (range) | 750 (700-800) | 750 (500-800) |

Figure 1. HO recurrence for patients undergoing RT prophylaxis with (N = 44) and without (N = 40) shielding of the prosthetic components.

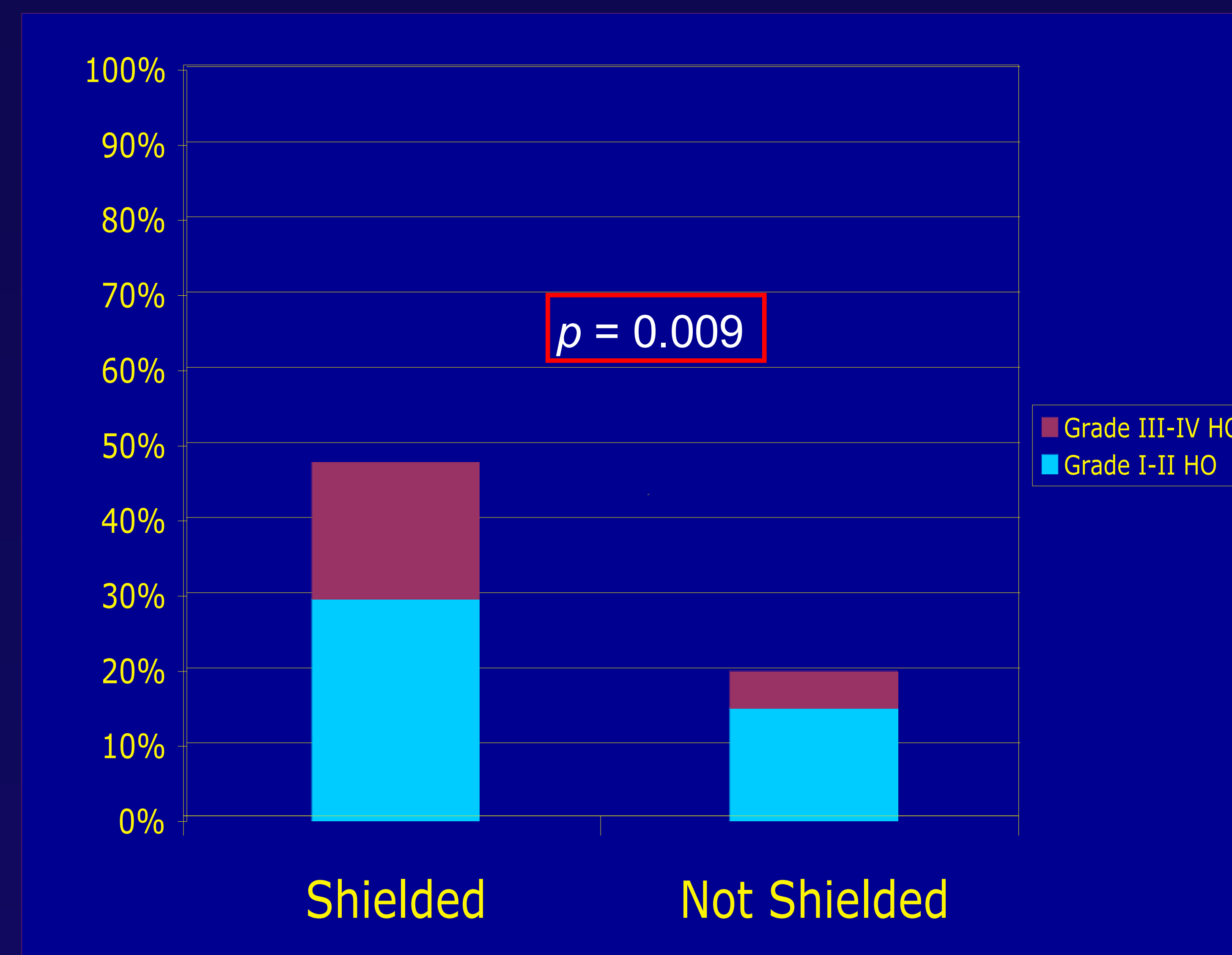


Table 2. Univariate and multivariate predictors of development of HO after RT prophylaxis.

| Univariate Analyses | | | Multivariate Analyses* | | |
|---------------------|-------------------|-------|------------------------|------------------|------|
| Predictor | OR (95% CI) | P | Predictor | OR (95% CI) | P |
| Shielding | 3.65 (1.38-9.68) | 0.009 | Shielding | 3.37 (1.21-9.43) | 0.02 |
| Male | 0.69 (0.25-1.88) | 0.46 | Age | 1.04 (1.00-1.09) | 0.07 |
| Age | 1.04 (1.00-1.08) | 0.06 | Infection | 5.21 (1.21-9.43) | 0.03 |
| HO history | 1.07 (0.33-3.48) | 0.91 | | | |
| Infection | 5.52 (1.31-23.31) | 0.02 | | | |
| RT Dose | 1.00 (0.99-1.01) | 0.71 | | | |
| Postop RT | 0.67 (0.26-1.74) | 0.41 | | | |

*Multivariate analysis performed with all variables with univariate p-values <0.20 entered simultaneously into the model.

Revision total hip arthroplasty required by presence of a chronic periprosthetic hip infection.

Results

137 patients were identified and 84 were eligible (64%). Patient characteristics are shown in Table 1.

Figure 1 graphically displays HO development according to shielding status. Eight of 40 unshielded patients (20%) developed any progression of HO compared to 21 of 44 shielded patients (48%) ($p = 0.009$). Grade III or IV HO developed in 5% of unshielded patients and 18% of shielded patients ($p = 0.08$).

THA for prior chronic periprosthetic hip infection was associated with a 70% rate of any grade HO and a 50% rate of grade III or IV HO.

Multivariate analysis demonstrated shielding and infection to be significant predictors of any HO development after RT prophylaxis. There was a trend toward age being a significant predictor of failure (Table 2).

Five patients developed any evidence of prosthesis failure, 4 in the shielded group, and 1 in the unshielded group ($p = 0.37$).

Conclusions

- § A significantly increased risk of failure of RT prophylaxis for HO was noted in those receiving shielding of the hip prosthesis.
- § Shielding did not appear to reduce the risk of prosthesis failure.