Patterns of Recurrence in Anal Canal Carcinoma

Moshe Faynsod, MD; Hernan I. Vargas, MD; Jorge Tolmos, MD; Vikram M. Udani; Sunil Dave; Tracey Arnell, MD; Bruce E. Stabile, MD; Michael J. Stamos, MD

Hypothesis: The initial modality of treatment of anal canal carcinoma (ACC) influences the pattern of recurrence of disease.

Design: A retrospective analysis comparing patterns of recurrence in patients with ACC undergoing either surgery or chemoradiotherapy as their initial therapeutic intervention. Anal margin cancers and adenocarcinomas were excluded.

Setting: A university-affiliated urban medical center.

Patients: Eighty-one patients were given a diagnosis of ACC between February 1, 1952, and December 31, 1998. Fifty-one (63%) of the patients initially underwent surgery: abdominoperineal resection in 38 patients (75%) and local excision in 13 patients (25%). Chemoradiotherapy was the initial therapeutic intervention in 30 patients (37%).

Main Outcome Measures: The patterns of recurrence (local vs distant disease) and survival were compared between the group that underwent palliative surgery (hereafter referred to as the surgical group) and the group that received chemoradiotherapy (hereafter referred to as the chemoradiotherapy group).

Results: The mean follow-up was 40 months. Local recurrence occurred in 7 patients (14%) in the surgical group vs 7 patients (23%) in the chemoradiotherapy group ($P = .46$). Using Kaplan-Meier actuarial analysis, local recurrence rates for the surgical and chemoradiotherapy groups at 1 year were 0% and 6%, respectively ($P = .32$), and at 5 years were 17% and 36%, respectively ($P = .02$). The average (±SD) time to local recurrence in the surgical group was 23±0.7 months and for the chemoradiotherapy group 16±2.9 months ($P = .27$). Five (71%) of the 7 patients with local recurrences in the chemoradiotherapy group underwent salvage abdomino-perineal resection with 100% disease-free survival at a mean follow-up of 35 months. When patients presenting with metastatic disease were excluded, distant recurrences developed in 7 patients (16%) in the surgical group and 2 (7%) in the chemoradiotherapy group ($P = .31$). Actuarial 5-year distant recurrence rates for the surgical and chemoradiotherapy groups were 26% and 19%, respectively ($P = .65$). Five-year survival was 42% in the surgical group and 74% in the chemoradiotherapy group ($P = .01$).

Conclusion: There was a higher rate of local recurrence in patients with ACC treated with chemoradiotherapy vs surgical resection as the initial therapeutic intervention. However, when this occurred, abdomino-perineal resection was effective salvage therapy and was associated with a 100% disease-free survival at 3 years. Therefore, chemoradiotherapy is justified as the initial treatment for ACC and has an overall 5-year survival that is significantly higher than that attained with initial surgical treatment.

Arch Surg. 2000;135:1090-1095

A

NAL CANAL carcinoma (ACC) is an uncommon disease accounting for only 3.9% of all anorectal carcinomas. An estimated 3400 cases of ACC will be diagnosed in the United States this year. Most of these tumors are cloacogenic, epidermoid, or squamous in origin. Historically, ACC was treated primarily by local surgical excision or abdomino-perineal resection (APR) with local recurrence rates as high as 50% and 5-year survivals rates of only 33% to 60%. More effective therapeutic alternatives were sought because of the disappointing outcomes of surgical treatment. Radiotherapy was traditionally considered a palliative intervention only. Initial attempts at using radiotherapy as a primary treatment were highly successful in eradicating the tumor but had unacceptable complication rates. The development of improved radiotherapy techniques with lower toxic effects and the addition of radiosensitizing chemotherapy caused a renewed interest in the nonsurgical treatment of ACC.
METHODS

The University of California, Los Angeles Medical Center Tumor Registry was used to identify all patients who received a diagnosis of ACC between February 1, 1952, and December 31, 1998. All patients with anal margin tumors and those with pathologic features identifying adenocarcinoma were excluded from the study.

Data were collected retrospectively by medical chart review including age, sex, date of diagnosis, tumor histologic features, tumor stage, type of primary therapy, subsequent therapy, date and site of recurrence, date of last follow-up, and date of death. Staging was determined using the TNM classification published by the American Joint Committee on Cancer Staging. Tumor size was determined by physical examination for patients undergoing chemoradiotherapy (hereafter referred to as the chemoradiotherapy group) and by pathologic examination of the excised specimens for patients treated surgically (hereafter referred to as the surgical group).

Local recurrence was defined as a biopsy specimen positive for carcinoma subsequent to a negative biopsy specimen following chemoradiotherapy or as a positive biopsy specimen of the anal canal or perineal region following surgical excision. All patients with initially positive biopsy specimens following completion of primary therapy were considered primary treatment failures rather than recurrences. Distant recurrence was defined as identification of metastatic tumor recurrence at a site not in direct continuity with the primary tumor site, including the internal iliac or inguinal lymph node chains.

Statistical analysis was performed by one of us (J.T.) using the t test for continuous variables. Categorical variables were compared using 2-sided χ² test with Yates correction for small numbers. P < .05 was considered statistically significant. Five-year recurrence and overall 5-year survival were determined using Kaplan-Meier survival analysis. Differences in actuarial results were determined using the log-rank test. All values are expressed as mean ± SD.

Nigro published data in 1984 for 104 patients that suggested that treatment with chemoradiotherapy alone yielded clinical outcomes similar to those of radical surgical excision. Surgery was reserved for residual disease after the primary nonsurgical treatment. Since this article, other investigators have assessed the efficacy and safety of primary chemoradiotherapy and have demonstrated good to excellent results relating to disease-free survival, sphincter preservation, and morbidity. As a result, there has been a move toward nonsurgical therapy for ACC with most cases treated with combination chemoradiotherapy as the primary intervention; the 5-year survival rates have ranged from 23% to 71%, depending on the cancer stage.

We have previously reported a 40-year experience with ACC and noted a similar shift toward chemoradiotherapy as the primary treatment. Our goal in this study was to elucidate whether the primary treatment modality affected the pattern of recurrence in this disease.

RESULTS

There were 81 patients treated for ACC over the 46-year period. The mean follow-up was 40 months (follow-up range, 8-184 months). Of the 81 patients, the primary therapy was chemoradiotherapy in 30 (37%) and surgical resection in 51 (63%), including APR in 38 (75%) and wide local excision in 13 (25%). Patient demographics are given in Table 1.

Two primary treatment failures were identified in the chemoradiotherapy group. While one of these patients was lost to follow-up, the second underwent salvage chemotherapy with a complete response and was disease free at 11 months’ follow-up.

Local recurrence occurred in 7 (23%) of the 30 patients who were primarily treated with chemoradiation at a mean time to recurrence of 16 ± 2.9 months. Seven (14%) of the 51 patients who underwent primary surgery developed local recurrences with a mean time to recurrence of 23 ± 5.6 months (P = .46). The time to local recurrence between the 2 groups was also not significantly different (P = .26). Using actuarial analysis, the 1-year local recurrence rate was 6% for the chemoradiotherapy group vs no recurrences in the surgical group (P = .32). The 5-year actuarial recurrence rates were significantly different at 36% and 17%, respectively (P = .02) (Figure 1). Five (71%) of the 7 patients who experienced local recurrences in the chemoradiotherapy group underwent salvage APR with a 100% disease-free survival at a mean follow-up of 35 months. Of the remaining 2, one was lost to follow-up while the other underwent salvage chemotherapy. When the primary surgical group was subdivided by operative procedure, 2 (15%) of 13 patients treated with wide local excision and 5 (13%) of 38 patients treated by APR had local recurrences (P = .77). Both patients with local recurrence after local excision had originally presented with stage II disease, while all 5 patients with local recurrence after APR had presented with stage III disease.

Four patients who initially underwent local excision were found to have positive margins and underwent a subsequent APR within 6 weeks of their initial procedure. These patients were categorized in the sur-

| Table 1. Demographics and Follow-up of 81 Patients With Anal Canal Cancer |
|-----------------|-----------------|-----------------|
| Patients Who Underwent Primary Chemoradiotherapy (n = 30) | Patients Who Underwent Primary Surgery (n = 51) |
| Patient Data | | |
| Age (range), y | 54 (26-71) | 57 (31-85) |
| Sex, No. (%) of patients | | |
| Male | 14 (47) | 26 (54) |
| Female | 16 (53) | 25 (46) |
| Follow-up (range), mo | 37.8 (8-177) | 40.8 (10-184) |
gical group as having undergone initial APR. None of these
patients experienced local recurrence following APR.
Of the 34 patients who underwent initial APR, 2 had
positive lateral margins. These were further treated with
adjunct chemotherapy consisting of fluorouracil and mito-
mycin. Of these patients, one developed carcinomatosis
within 1 year while the other developed lung metastasis at
16 months postoperatively.
Seven (14%) of the 51 surgical patients had distant
recurrences, while 2 (7%) of 30 patients who received
primary chemoradiotherapy had distant recurrences
\( (P = .49) \). The actuarial 5-year distant recurrence rates were
26% for the surgical group vs 19% for the chemoradio-
therapy group \( (P = .65) \). No statistically significant differ-
ces were found when specific sites of distant recur-
rence were compared between the groups. Table 2 lists
the sites of distant recurrence for each group.
Table 3 gives the distribution of patients in each
primary treatment group by stage of disease at presenta-
tion together with their incidences of local and distant
recurrences. There were no significant differences. The
actuarial 5-year survival rate was 42% for patients who
underwent primary surgery vs 74% for those who re-
ceived primary chemoradiotherapy \( (P = .01) \) (Figure 2).

In 1973, Nigro et al\(^{11}\) first reported a series of 3 cases of
epidermoid carcinoma of the anal canal treated with ex-
ternal beam radiation (30 Gy) and chemotherapy con-
sisting of a combination of mitomycin and fluorouracil.
This was followed by surgical excision after 6 weeks in
2 patients, neither of whom had tumor found in the pa-
thology specimen. Since then, several investigators have
demonstrated the success of sphincter preservation by
using primary chemoradiotherapy for the treatment of ACC.\(^{12}\) We have studied the pattern of recurrence of ACC
after either palliative surgery or chemoradiotherapy in a
population treated over a 46-year span. Our study rep-
resents a historical analysis. Prior to the early 1980s, our
primary approach to ACC was surgical, reflecting the stan-
dard of care at the time. With the introduction of the Ni-
gro et al protocol,\(^{13}\) our institution altered its paradigm
for the treatment of ACC. Since then, we have been treat-
ing ACC with primary chemoradiotherapy. In our se-
ries, 28 (93%) of 30 patients treated with primary che-
moradiotherapy received between 43 and 55 Gy in com-
bination with mitomycin and fluorouracil. Most (63%)
of the patients were treated in the years prior to the wide-
spread adoption of the Nigro et al protocol. The last sur-
gical resection performed as primary therapy for ACC was
an APR in 1988. In recent years, surgical resection has
been reserved for recurrence or primary failure after ini-
tial chemoradiotherapy.

Using actuarial data analysis, a higher rate of local tu-
mor recurrence at 5 years was found in patients who un-
derwent initial chemoradiotherapy compared with pa-
tients who underwent primary surgical excision. Longo et
al\(^{14}\) reviewed 159 patients with ACC and found tumor stage
and method of initial treatment affected the likelihood of
disease recurrence. They found an 11% local recurrence
rate among patients with stage I disease treated with mul-
timodal therapy vs 41% in patients with stage II dis-
ease. They also found that APR afforded better local con-
trol when compared with chemoradiotherapy. These results
mirror our findings. Our data also suggest that surgery is
a more effective means of providing local control. Addi-
tionally, substantial differences in the stage distributions
were noted between the treatment groups at initial pre-
sentation, making the local control advantage even more
impressive. The surgical group contained most (53%) of
stage III and IV tumors while the chemoradiotherapy group
had a smaller proportion (33%) of these advanced tu-
mors. However, the patients who underwent chemoradio-
therapy were very likely understaged owing to the lack of
surgical specimens for pathologic staging. This may ac-
count for the higher local recurrence rates observed among
patients with stage I and II disease initially treated with che-
moradiotherapy.

COMMENT

![Figure 1. Kaplan-Meier local recurrence-free survival.](image-url)

Table 2. Site of Distant Recurrence by Primary Therapy and by Stage of Disease*

<table>
<thead>
<tr>
<th>Site</th>
<th>Patients Who Underwent Primary Chemoradiotherapy (n = 2)</th>
<th>Patients Who Underwent Primary Surgery (n = 7)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Patients Presenting Cancer Stage</td>
<td>No. of Patients Presenting Cancer Stage</td>
</tr>
<tr>
<td>Brain</td>
<td>1 (III)</td>
<td>1 (III)</td>
</tr>
<tr>
<td>Liver</td>
<td>1 (III)</td>
<td>1 (III)</td>
</tr>
<tr>
<td>Lung</td>
<td>0 (NA)</td>
<td>2 (II)</td>
</tr>
<tr>
<td>Carcinomatosis</td>
<td>0 (NA)</td>
<td>2 (III)</td>
</tr>
<tr>
<td>Unknown</td>
<td>0 (NA)</td>
<td>1 (III)</td>
</tr>
</tbody>
</table>

*Based on Reming et al\(^{9}\); NA indicates not applicable.
Tables 3. Recurrences by Stages of Disease*

<table>
<thead>
<tr>
<th>Stage</th>
<th>All Patients</th>
<th>Local Recurrence</th>
<th>Distant Recurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>7 (24)</td>
<td>1 (14)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>II</td>
<td>11 (37)</td>
<td>4 (36)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>III</td>
<td>8 (27)</td>
<td>2 (25)</td>
<td>2 (25)</td>
</tr>
<tr>
<td>IV</td>
<td>2 (6)</td>
<td>0 (0)</td>
<td>NA</td>
</tr>
<tr>
<td>Unknown</td>
<td>2 (6)</td>
<td>0 (0)</td>
<td>0</td>
</tr>
<tr>
<td>Total, No. (%)</td>
<td>30 (100)</td>
<td>7 (23)</td>
<td>2 (7)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage</th>
<th>All Patients</th>
<th>Local Recurrence</th>
<th>Distant Recurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>5 (10)</td>
<td>0 (0)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>II</td>
<td>12 (4)</td>
<td>2 (17)</td>
<td>2 (17)</td>
</tr>
<tr>
<td>III</td>
<td>17 (33)</td>
<td>5 (29)</td>
<td>5 (29)</td>
</tr>
<tr>
<td>IV</td>
<td>12 (23)</td>
<td>0 (0)</td>
<td>NA</td>
</tr>
<tr>
<td>Unknown</td>
<td>5 (10)</td>
<td>0 (0)</td>
<td>1 (20)</td>
</tr>
<tr>
<td>Total, No. (%)</td>
<td>51 (100)</td>
<td>7 (14)</td>
<td>8 (16)</td>
</tr>
</tbody>
</table>

*NA indicates not applicable.

In summary, our findings emphasize the need for careful surveillance for recurrence, particularly local recurrence, after treatment with primary chemoradiotherapy. In such instances of local recurrence, APR provided effective salvage treatment with excellent disease-free survival after medium-length follow-up. We are investigating the utility of salvage chemotherapy in cases of local recurrence after primary chemoradiotherapy based on the encouraging results of reported preliminary clinical experience.15


Corresponding author: Michael J. Stamos, MD, Department of Surgery, Harbor-UCLA Medical Center, Box 25, 1000 W Carson St, Torrance, CA 90509 (e-mail: mstamos@ucla.edu).

References

Theodore E. Schrock, MD, San Francisco, Calif: The authors are to be congratulated on this retrospective review of an uncommon disease that is difficult to study prospectively at any single institution or even in multi-institutional cooperative trials. Good records, proper categorization, and statistical analysis make for an excellent contribution. The authors appropriately limited their study population to patients with ACC since carcinoma of the anal margin and any histological pattern other than epidermoid are different biologically and surgically.

The combination of chemotherapy and radiotherapy for ACC was revolutionary when introduced by Nigro in the early 1970s. Prior to that time radical extirpative surgery was the treatment of choice. Patients treated by APR not only had permanent colostomies, but also attempts to obtain wide local margins around bulky tumors sometimes led to large, slowly healing wounds or long-term disability from perineal hernias or vaginal stenosis. Further, the surgical approach sometimes was extended to include radical ilioinguinal lymphadenectomy and its attendant morbid consequences for the lower extremities. In the 1960s many surgeons joined with their radiation oncology colleagues to treat this disease by radiotherapy, initially intended to be followed by surgical extirpation, but eventually as an alternative to excision. Nigro demonstrated that chemotherapy effectively enhanced the treatment locally, regionally, and systemically, and within a short time this approach was adopted by surgeons worldwide.

The authors pose the question whether the patterns of recurrence are different if the primary treatment is surgical excision or chemoradiotherapy. In their population of 81 patients between 1952 and 1998, 51 (66%) underwent primary surgical treatment. The presenter, Dr Faynsod, dealt with my first question which is simply: why such a large proportion of these patients were treated surgically. The answer he gave us is that those were largely patients earlier in the experience.

The authors found a greater rate of local recurrence in the chemoradiation group, although it was statistically insignificant except by actuarial analysis at the 5-year point. We should recognize as a point of terminology that particularly when the initial treatment was chemoradiotherapy, we were talking about persistence of tumor here more than recurrence. Local recurrence after chemoradiotherapy was defined as a positive biopsy specimen subsequent to a negative biopsy specimen. That implies routine biopsies are performed for these patients. Since some surgeons do not obtain biopsy specimens routinely, I am curious about the authors’ recommendation.

Salvage abdominoperineal for local recurrence after chemoradiation had uniformly good outcomes over the short-term. Some groups give another course of chemoradiotherapy instead of operating on patients with local persistence or recurrence, even boosting the radiation dose quite high. Have the authors taken that approach, and what is their current protocol to treat local persistence or recurrence after chemoradiotherapy? Importantly, long-term survival was greater in patients treated by primary chemoradiation, although this comparison is weakened by the stage differences pointed out in these 2 populations.

With a small risk of overinterpreting the data, one may conclude that the authors have successfully treated patients with ACC by primary chemoradiation, followed them closely, intervened surgically for local recurrence, and thereby limited the morbidity of radical operation to a few patients without sacrifice of long-term survival in most.

One final question to the authors. Are there any patients today in whom you would choose abdominoperineal resection primarily.

Karen Deveney, MD, Portland, Ore: I too enjoyed this paper, possibly because it also agrees with the treatment that we have used over the last 20 years, primary chemoradiotherapy. It has been my experience, however, that delayed healing occurs when APR is done long after chemoradiation. Can one potentially identify any subgroup, either with histological characteristics or gross characteristics such as the local extent of invasiveness, poor differentiation, cytologic subgrouping, or rapid growth rate, which might predict that they will do worse and perhaps employ APR first with postoperative chemotheraphy in this?

It has also been our experience that the chemotherapy can have quite toxic effects in some of these patients, especially if they are aged. Was there a standard chemotherapy regimen, and were there any significant morbidities or mortality from the chemotherapy itself?

I also agree with the possible understaging in the chemotherapy group and would like to ask if you are employing endorectal ultrasound better to stage these patients preoperatively at the present.

William P. Schecter, MD, San Francisco: I also enjoyed this study very much. I noticed that the period spanned 1952 to 1998, but the epidemiology of squamous cell carcinoma of the anus has changed dramatically with the AIDS [acquired immunodeficiency syndrome] epidemic and the changing demographics of the gay population. Although it is true that the biology of anal cancer is probably different than anal margin cancers noted by Dr Schrock, I believe that most cases of squamous cell carcinoma of the anus are due to sexually transmitted infection, part of the spectrum of human papillomavirus infection ranging from dysplasia to invasive cancer. I am rising to remind surgeons that gay patients who present with warts are at high risk for the development of invasive squamous cell carcinoma of the anus and should be carefully followed up and screened. I also noticed that your male-to-female ratio across this entire period was almost 1:1 whereas in the [San Francisco] Bay Area the previous sex ratio was 3:1 in favor of women, but in the last 15 years it has changed to 2:1 in favor of men. Did you notice a change in sex ratios over the period of your study?

Finally I would also like to comment about a group of patients in which I think it is not a good idea to give up front chemoradiotherapy—patients with a big Buschke-Loewenstein tumor greater than 7 or 8 cm. The Nigro protocol was really designed for tumors less than 4 cm, and I think if you have a bulky infected tumor, you do the patient a disservice by giving chemoradiotherapy first because it is much more difficult to salvage the patient without a lot of postoperative morbidity when operating in an irradiated field.

Albert D. Hall, MD, Greenbrae, Calif: Do you have patients who presented with advanced anal squamous carcinoma and bilateral groin lymph node metastases whom you treated with primary APR and groin dissections? Is it rational to consider a primary surgical approach when the anal cancer is bulky and the workup shows only groin lymph node metastases?

Dr Stabile: As you have heard, ACC is a rare disease and constitutes only a small percentage of gastrointestinal tract tumors. As Dr Schecter and others have noted, there seems to be an increasing incidence of the disease in our population that may be related to sexual transmission of human papillomavirus-16 and other viruses that might have causative roles.

We have learned over the years that there are several outcome determinants that we need to pay particular attention to. Most importantly is the stage of the disease. This is utmost in terms of planning therapy and establishing prognostic estimates. The use of endorectal ultrasound has augmented our ability to stage these patients accurately at the time of
their presentation. Another outcome determinant has been sex. Historically, the female group has been much the larger and has fared better stage for stage. Males, seem to be disadvantaged, given a particular stage and a particular therapy. The treatment used is the other important determinant of outcome.

Dr Schrock gave a nice encapsulation of the history of the treatment of ACC. The early surgical results were not only deforming because the patients lost their anorectums, but they were also not particularly satisfactory for long-term outcomes. Dr Schrock mentioned the issue of whether there was persistence of disease rather than recurrence in the group treated with chemotherapy. We routinely obtained biopsy specimens of all patients 6 to 8 weeks following completion of their therapeutic course, and only 2 patients were discovered by that method to actually have persistent disease. All of the other patients had initially negative biopsy specimens and were subsequently found on later follow-up to have recurrent tumors. This is not to say that there were not sampling errors, and Dr Schrock's point is well taken. Certainly, some proportion of these patients who are termed recurrences may, in fact, have had persistent disease that was missed by the biopsy technique.

Dr Schrock asked about our experience with salvage chemoradiotherapy. Thus far, we have only had 2 such patients and they have been treated with salvage chemotherapy using a cisplatin-based regimen. One patient died of persistent disease 2 years later, and the other patient was lost to follow-up after completion of the salvage chemotherapy regimen.

We have not used resective therapy as the primary treatment for 12 years now. Our last patient treated primarily by surgical resection received an APR in 1988. We have since converted entirely to the chemoradiotherapy as primary therapy.

Dr Deveney asked whether there were predictors that might help stratify patients as to risk of recurrence and we and others have found that only stage of disease seems to predict this with any statistical power. We have looked at histological and other features of the tumor, but only pathologic stage has been an accurate predictor of recurrence.

Dr Deveney questioned the morbidity of chemoradiation treatment. We have had one serious consequence of the use of the chemoradiotherapy protocol, and that was in a patient who developed renal failure and subsequently died of the complication.

Dr Schecter well enunciated the issue of sexually transmitted disease, and we routinely perform HIV [human immunodeficiency virus] testing in these patients. There seems to be a changing sex incidence in the disease. It is interesting that in our series, which differs from most in the literature, there has been a slight predominance of male patients from the outset and throughout the series.

In terms of the bulky Buschke-Lowenstein tumors, we have not seen one recently, but I would agree with Dr Schecter that it is probably inappropriate to embark initially on a chemoradiotherapy protocol. We would do a debulking operation or a local excision prior to beginning chemoradiotherapy.

Dr Hall inquired about our use of radical lymph node dissection. We have not performed radical lymph node dissection on any of the patients in our series. I think the literature would strongly support that it is not a highly beneficial procedure in this disease, although there probably are anecdotal cases where it has provided good palliation.

ARCHIVES OF INTERNAL MEDICINE

Bundle-Branch Block as a Risk Factor in Noncardiac Surgery

Todd Dorman, MD; Michael J. Breslow, MD; Peter J. Pronovost, MD; Peter Rock, MD; Brian A. Rosenfeld, MD

Background: Despite extensive data examining perioperative risk in patients with coronary artery disease, little attention has been devoted to the implications of conduction system abnormalities.

Methods: Retrospective, cohort-controlled study of all noncardiac, nonophthalmologic, adult patients with BBB seen in our preoperative evaluation center. Medical charts were reviewed for data regarding cardiovascular disease, surgical procedure, type of anesthesia, intravascular monitoring, and perioperative complications.

Results: Bundle-branch block was present in 455 patients. Right BBB (RBBB) was more common than left BBB (LBBB) (73.8% vs 26.2%). Three patients with LBBB and 1 patient with RBBB died; 1 patient had a supraventricular tachyarrhythmia. Three of the 4 deaths were sepsis related. There were 2 (0.4%) deaths in the control group. There was no difference in mortality between BBB and control groups (P = .32). Subgroup analysis suggested an increased risk for death in patients with LBBB vs controls (P = .06; odds ratio, 6.0; 95% confidence interval, 1.2-100.0) and vs RBBB (P = .06; odds ratio, 8.7; 95% confidence interval, 1.2-100.0).

Conclusions: The presence of BBB is not associated with a high incidence of postoperative cardiac complications. Perioperative mortality is not increased in patients with BBB and not directly attributable to cardiac complications in patients with LBBB. These data suggest that the presence of BBB does not significantly increase the likelihood of cardiac complications following surgery, but that patients with LBBB may not tolerate the stress of perioperative noncardiac complications.

Corresponding author: Todd Dorman, MD, The Johns Hopkins Hospital, Department of Anesthesiology, 600 N Wolfe St, Meyer 299A, Baltimore, MD 21287-7294 (e-mail: tdorman@jhmi.edu).

Reprints not available from the authors.