Cost Benefit Analysis of Same Day Pregnancy Tests in Elective Orthopaedic Surgery

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Abstract

Summary: We reviewed the results of 4,723 day of surgery pregnancy tests performed at two of our institution’s locations, our ambulatory surgery center and our acute orthopaedics hospital over a 23 month time period. All patients were scheduled for elective orthopaedic surgery. There were seven positive results (0.15%) and one false negative result (0.02%). The cost per positive result for both hospital locations was $1,005.32.

Introduction: Performing elective surgery on pregnant women can harm the mother and fetus. In order to minimize the likelihood of this happening, we administer a urine pregnancy test to each woman of childbearing age on the date of surgery. From November 2009 to September 2011, we performed 4,723 urine human chorionic gonadotropin (hCG) pregnancy tests on the day of surgery. We reviewed the results and cost of each pregnancy test. We then used these results to calculate the percentage of positive tests and the cost of diagnosing each pregnant female on the date of their surgery.

Methods: We obtained the records of all urine hCG pregnancy tests performed from November 2009 to September 2011. Each test was reviewed to determine if the result was positive or negative. Costs were calculated using the charges incurred for a qualitative hCG pregnancy test. We then contacted each patient with a positive result to determine if the urine hCG test results were accurate.

Results: 4,723 pregnancy tests were reviewed over a 23 month period with 7 (0.15%) having a positive result. Over the 23 month time period, we were notified of one false negative result (0.02%). The Positive Predictive Value (PPV) was 100% and the Negative Predictive Value (NPV) was 99.9%. The cost of a single urine hCG test was $1.49, the total cost for all 4,723 tests was $7,037.27. The cost of diagnosing 7 positive tests was $1,005.32.

Conclusion: Routinely performing urine hCG pregnancy tests on the day of surgery is a cost effective method of preventing elective orthopaedic surgery on pregnant women. Of 4,723 women tested 7 had a positive result and 1 had a false negative result. The cost of $1,005.32 for each positive test must be compared with the benefit of not performing elective surgery on a pregnant female.

An estimated 0.75% to 2% of pregnant women will undergo non-obstetric surgery during their pregnancy. In the USA, approximately 75,000 to 80,000 parturients will be exposed to anesthesia and surgery each year, and these figures are likely to be underestimated because pregnancy may be unrecognized at the time of surgery, and patient history is insufficient by itself in eliminating the potential of pregnancy.1-5 Positive pregnancy tests have been reported in 0.3% to 1.2% of females presenting for routine surgery.1,6 It is debatable whether exposure to anesthesia and surgery during pregnancy places the mother or fetus at risk for complications. There appears to be an increased incidence of spontaneous abortion and congenital defects in women undergoing surgery during their first trimester of pregnancy.7-9 Being able to recognize a pregnancy prior to surgery enables the woman and her physician to make an informed decision.3,10-12 In a study performed by Kahn and coworkers,10 a hospital wide policy was implemented for all menstruating women to undergo urine hCG testing. Of 2,588 patients tested, 5 had a positive result, and their surgery was...
cancelled. Of the five patients, three had pregnancies which were previously unrecognized, one was an asymptomatic ectopic pregnancy, and the other a false positive result in a perimenopausal woman. The other three women had a weak positive urine result followed by a negative serum hCG. The hospital’s policy of routinely performing urine hCG pregnancy tests in women of childbearing age on the day of surgery was effective in detecting unrecognized pregnancies. This resulted in a postponement of elective surgery in all five cases. In another study, Duncan and colleagues explored the incidence of congenital anomalies and spontaneous abortion in 2,565 women who had anesthesia for surgery during their pregnancy, comparing them with a similar number of pregnant women not exposed to anesthesia. Statistical analysis showed no significant difference in the number of congenital anomalies between the study and control group, but the subgroup of women who received a general anesthetic appeared to be at higher risk for spontaneous abortion. In order to minimize the likelihood of performing elective orthopaedic surgery on a pregnant patient, we administer a urine pregnancy test to each woman of menstruating age on the date of surgery.

Materials and Methods

The study was approved by the appropriate IRB. Informed consent was not necessary as this was a retrospective chart review.

The hospital maintains a database of all pregnancy test results. We performed a retrospective chart review of all positive urine pregnancy tests during a 23 month time period. We also reviewed the medical records of all cases receiving a urine pregnancy test to ensure that each case was purely elective and not urgent. It is our institution’s policy that all female surgical patients of menstruating age have a first morning specimen obtained on the day of surgery. Additionally, when patients go for preadmission testing, pregnancy tests are performed but because there can be a 1 to 2 week lag between preadmission testing and surgery, pregnancy tests are again performed on the day of surgery to identify as many pregnancies as possible. Pregnancy tests performed on the day of surgery are obtained in the holding area by a nurse, thus there are no additional costs of performing the test, and the operating schedule is not interrupted by this test.

At both our ambulatory surgery center and acute orthopaedics hospital, we perform urine tests. The urine is tested for human chorionic gonadotropin (hCG). Once a fertilized egg implants, the developing placenta begins to release hCG, which can be detected by a urine or serum test before the first missed menses and as early as 6 days after implantation. We obtained the records of all hCG pregnancy tests performed from November 2009 to September 2011. Each test was reviewed to determine if the result was positive or negative. Costs were calculated using the charges incurred for a qualitative hCG pregnancy test with the cost of a single test being $1.49. We then contacted each patient with a positive result to determine if the urine hCG test results were accurate.

Results

From November 2009 to September 2011, 4,723 pregnancy tests were performed for women having elective surgery at our institution (Table 1). Of the 4,723 pregnancy tests performed, 7 (0.15%) had a positive result. These surgeries were cancelled, and patients were referred to their personal physicians for confirmation of the diagnosis and further care. During the 23 month time period that we retrospectively reviewed pregnancy tests performed, we were notified of one false negative result (0.02%) by a patient at a postoperative visit. The patient with the false negative carried to term, and there were no complications due to surgery. The Positive Predictive Value (PPV) was 100%, and the Negative Predictive Value (NPV) was 99.9%. The cost of a single urine hCG test was $1.49; the total cost for all 4,723 tests was $7,037.27. The cost of diagnosing each of the 7 pregnancies on the day of surgery was $1,005.32. All patients presenting with a positive pregnancy test were contacted by one of our investigators to confirm the result.

Discussion

In a study performed by Manley and associates, the incidence of unrecognized pregnancies in women of childbearing age presenting for elective surgeries was noted to be 0.3%. About 40% of white women and 64% of black women will experience at least one pregnancy before reaching the age of 20. Thus, it is essential to determine if a woman is pregnant prior to surgery, especially a teenager, as surgery performed under general anesthesia on a patient with an unrecognized pregnancy can potentially cause a number of problems including, but not limited to, fetal asphyxia, maternal injury, preterm labor, intrauterine growth retardation, and miscarriage. Thus, not only is it essential to routinely perform urine hCG pregnancy tests on the day of surgery, but it is also a cost effective method of preventing elective orthopaedic surgery on pregnant women.

We performed a cost benefit analysis of day of surgery pregnancy testing at our institution. Over a 23 month time period, 4,723 women received hCG pregnancy tests at our institution on the morning of surgery. Of the 4,723 tests performed, 7 had a positive result and 1 had a false

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Pregnancy Tests Performed on the Day of Surgery (Data November 2009 to September 2011)</th>
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<tbody>
<tr>
<td>Number of Tests</td>
<td>Number Positive</td>
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<td>---------</td>
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<tr>
<td>4,723</td>
<td>7 Positive</td>
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<tr>
<td>1 False Negative</td>
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negative result. A study similar to ours performed by Kahn and coworkers\textsuperscript{10} reviewed their experience with day of surgery pregnancy testing before elective orthopaedic procedures over a one year time period. The hospital instituted a policy for all women of childbearing age to undergo a urine hCG test on the day of surgery. During the first year of implementation 5 of 2,588 patients had a positive result (0.19%), and 4 of 2,588 had a true positive result (0.15%) with a cost of $3,272 per true positive test. The cost for each urine hCG test was $5.03. As a result of these findings the investigator states “of these five, three were previously unrecognized pregnancies, one was an unrecognized asymptomatic ectopic pregnancy, and one a false-positive result in a perimenopausal woman. Routinely performing urine pregnancy tests on menstruating women the day of surgery was an effective method in detecting unrecognized pregnancies.”\textsuperscript{10} In both our study and that performed by Kahn and coworkers, there was an identical percentage of day of surgery true positive hCG tests (0.15% vs. 0.15%). However, in our study the cost per true positive test ($1005.32) was significantly less than that reported by Kahn and coworkers ($3,272) (p > 0.05) but was not statistically significant. The decrease in cost of identifying pregnant women on the day of surgery is completely attributed to the decrease cost of the urine hCG tests. The cost of the tests at each institution varied due to urine tests being used by different companies. The cost of identifying and preventing surgery on pregnant females must be compared with the benefit of not performing elective surgery on a pregnant female. The average cost per case is $4,900, and each case cancelled amounts to a loss of $4,900 to the hospital. Yet the cost of the cancelled surgery amounts to a day of lost wages to the patient, which is much harder to calculate. It is our opinion that the cost of $1005.32 per true positive test justifies avoiding surgery on these pregnant women.

**Disclosure Statement**

None of the authors have a financial or proprietary interest in the subject matter or materials discussed, including, but not limited to, employment, consultancies, stock ownership, honoraria, and paid expert testimony.

**References**