# Optimization of Perioperative Cefazolin for Scoliosis Surgery

Howard Epps, MD¶, Charlene Hallmark, RN¥, Kenneth Kocab, RN¥, Thomas Luerssen, MD‡, Megan May, MD¶, Bryan Pickryl, MBA¥, Carrie Smith, BA¥

*Departments of Orthopaedic Surgery¶ and Neurosurgery‡, Baylor College of Medicine and Texas Children's Hospital¥*

## BACKGROUND

Surgical site infection (SSI) after scoliosis surgery is a devastating complication. Management requires readmission, multiple trips to operating room, prolonged antibiotic therapy, and costs at our institution at least $21,000/patient. This complication is not APR-DRG reimbursable. It is estimated that 40-60% of SSI are preventable with appropriate prophylaxis, but optimal timing of delivery is controversial. Cefazolin is the antibiotic of choice for adolescent idiopathic scoliosis (AIS) surgery. Peak concentrations in plasma and tissue occur 30 minutes after administration.

## PURPOSE

We hypothesized that standardization of the delivery process would significantly improve rates of optimal delivery of cefazolin for AIS surgery.

## METHODS

- Optimal administration of cefazolin was defined as the initial dose given 20 to 60 minutes prior to incision, and for redosing as 225 to 255 minutes after the previous dose (4 hours ± 15 minutes).
- Retrospective review of 57 cases revealed that optimal preop and redosed antibiotics occurred 44% and 56% of the time respectively.
- Analysis of 10 consecutive posterior fusions with instrumentation (PSIF) for AIS, identified 13 discrete steps prior to incision. Turning the patient to prone position occurred on average 33 minutes prior to incision.
- The new process involved routine administration of the first dose of cefazolin immediately prior to prone positioning. For redoing, a digital timer was set for 4 hours after the initial dose, and the desired time for redosing added to the Time Out to increase team awareness.

| Pre-op | | Redosing | |
|---|---|---|---|
| Timing of Dosing | Percentage of Cases (N=70) | Timing of Dosing | Percentage of Cases (N=47) |
| <20 minutes | 37% | <225 minutes | 27% |
| 20-60 minutes | 44% | 225-255 minutes | 56% |
| >60 minutes | 9% | >255 minutes | 17% |
| Pre-op target 20-60 min | | Redosing target 225-255 min | |

Fig 1. Historically there was wide variation in cefazolin dosing for scoliosis surgery at TCH

| | BASELINE | 3 MONTHS | 6 MONTHS |
|---|---|---|---|
| % Optimally Timed Pre-Operative Cefazolin | 44% | 93%* | 82%* |
| % Optimally Timed Intra-Op Cefazolin Redose | 58% | 71% | 72% |

*p<0.0005

Fig 2. Pre-op and intra-op cefazolin dosing post intervention

| | | |
|---|---|---|
| Within 60 min of incision | Bratzler, et al | Am J Surg 189(4): 395-404, 2005 |
| Within 60 min of incision | Nishant | Asian Spine J 7: 196-203, 2013 |
| 0-18 minutes prior to incision, general surgery | Koch, et al | J Am Coll Surg 217(4): 628-635, 2013. |
| Timing not as important as choice of antibiotic | Hawn, et al | J Am Coll Surg 206(5): 814-819, 2008, JAMA Surg 148(7): 649-657, 2013 |

Fig 3. Optimal time for dosing is controversial

## RESULTS

- There were 43 PSIF cases during the initial observation period an additional 87 total cases during the 2nd observation period.
- Percentage of optimally timed preoperative antibiotics increased from 44% to 93% in the first 3 months ($p<0.0005$)
- The rate dropped to 82% at 6 months ($p<0.0005$)
- Appropriate administration for redosing rose from 56% to 71% and 72% during the 2 observation periods, which did not reach significance

## CONCLUSION

Systematic analysis of perioperative routines can facilitate the creation of processes which can improve preoperative antibiotic administration. Vigilance is necessary to maintain adherence.

For redosing other strategies like notification through the electronic health record may be needed.
Process applicable to AIS only, not neuromuscular or other more complex patients.

## REFERENCES

1. Bratzler, D. W., et al. (2005). "Antimicrobial prophylaxis for surgery: an advisory statement from the National Surgical Infection Prevention Project." Am J Surg 189(4): 395-404.
2. Hawn, M. T., et al. (2008). "Association of timely administration of prophylactic antibiotics for major surgical procedures and surgical site infection." J Am Coll Surg 206(5): 814-819; discussion 819-821
3. Hawn, M. T., et al. (2013). "Timing of surgical antibiotic prophylaxis and the risk of surgical site infection." JAMA Surg 148(7): 649-657.
4. Koch, E., et al. (2013). "Is It Time to Refine? An Exploration and Simulation of Optimal Antibiotic Timing in General Surgery." J Am Coll Surg 217: 628-635.
5. Douglas A., et al. (2011) "Plasma and tissue pharmacokinetics of cefazolin in patients undergoing elective and semielective abdominal aortic aneurysm open repair surgery. Antimicrob Agents Chemother 55(11):5238-42.
6. Nishant, Kannan Karthick Kailash, P.V. Vijayraghavan. (2013) "Prospective Randomized Study for Antibiotic Prophylaxis in Spine Surgery: Choice of Drug, Dosage, and Timing. Asian Spine J 7(3):196-203