Microbial profile of biliary stent, bile and surgical site cultures in pancreaticoduodenectomy patients – Implications for surgical prophylaxis

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Background

Surgical site infection (SSI) rates post pancreaticoduodenectomy (PD) range from 20 to 40%. Biliary obstruction (± stent in situ) leads to colonization of the biliary tract with gut flora, and bile contamination during surgery increases SSI risk. Current guidelines recommend surgical prophylaxis (ppx) with 1st or 2nd generation cephalosporins. However, emerging data favor targeted ppx based on biliary cultures to reduce SSI. We reviewed the microbial profile of pathogens isolated from perioperative biliary stent and bile cultures, and evaluated the impact of ppx on culture positive SSIs within 30 days of PD.

Methods

This was a retrospective study conducted in SGH. Patients who had PD from 1/1/2013 to 31/12/2019 were included. The first positive cultures from perioperative biliary stent, bile, and SSI cultures obtained within 30 days of surgery were reviewed. Antibiotic use 30 days prior & during surgery was collected.

Organism	Susceptibility rates (no. of isolates susceptible to antibiotic/no. of isolates tested for susceptibility)		
	Total	Ampicillin	Vancomycin
***Enterococcus* spp. (non-faecium)**	N=56	56/56 (100.0%)	44/56 (78.6%)
	N=38	36/38 (94.7%)	32/38 (84.2%)
	N=16	15/16 (93.8%)	15/16 (93.8%)
Enterococcus faecium	N=11	5/11 (45.5%)	7/11 (63.6%)
	N=12	8/12 (66.7%)	10/12 (83.3%)
	N=10	1/10 (10.0%)	8/10 (80.0%)
***Streptococcus* spp.**	N=9	8/9 (88.9%)	9/9 (100.0%)

Table 1: Microbial susceptibility profile of gram-positive isolates (species with n>3)

Organism	Fungal isolates
***Candida* spp.**	N=26 10 *C. albicans*, 8 *C. tropicalis*, 3 *C. dubliniensis*, 2 *C. glabrata*, 1 *C. kefyr*, 1 *C. krusei*, 1 undefined
	N=22 10 *C. albicans*, 6 *C. tropicalis*, 2 *C. glabrata*, 1 *C. dubliniensis*, 1 *C. krusei*, 2 undefined
	N=23 7 *C. albicans*, 5 *C. glabrata*, 4 *C. dubliniensis*, 3 *C. tropicalis*, 4 undefined

Table 2: Fungal isolate profiles

Table Legend: Bile Stent | Bile | Surgical site | No data/not applicable

Organism	Susceptibility rates (no. of isolates susceptible to antibiotic/no. of isolates tested for susceptibility)								
	Total	Co-amoxiclav	Cefazolin	Ceftriaxone	Cefepime	Pip-tazo	Ertapenem	Ciprofloxacin	Gentamicin
***Klebsiella* spp.**	N=28	15/28 (53.6%)	7/19 (36.8%)	15/28 (53.6%)	16/28 (57.1%)	21/28 (75.0%)	27/28 (96.4%)	13/28 (46.4%)	19/28 (67.9%)
	N=26	12/26 (46.2%)	5/16 (31.3%)	11/26(42.3%)	10/26 (38.5%)	16/26 (61.5%)	26/26 (100.0%)	13/26 (50.0%)	19/26 (73.1%)
	N=18	6/18 (33.3%)	0/11 (0.0%)	3/18 (16.7%)	3/18 (16.7%)	10/18 (55.6%)	16/18 (88.9%)	6/18 (33.3%)	11/18 (61.1%)
Escherichia coli	N=20	12/20 (60.0%)	5/15 (33.3%)	10/20 (50.0%)	12/20 (60.0%)	17/20 (85.0%)	20/20 (100.0%)	13/20 (65.0%)	18/20 (90.0%)
	N=31	19/31 (61.3%)	8/31 (25.8%)	17/31 (54.8%)	20/31 (64.5%)	25/31 (80.6%)	30/31 (96.8%)	16/31 (51.6%)	26/31 (83.9%)
	N=18	12/18 (66.7%)	1/13 (7.7%)	4/18 (22.2%)	5/17 (29.4%)	15/17 (88.2%)	17/18 (94.4%)	5/18 (27.8%)	10/18 (55.6%)
***Enterobacter* spp.**	N=17			8/17 (47.1%)	15/17 (88.2%)	8/17 (47.1%)	14/17 (82.4%)	13/17 (76.5%)	16/17 (94.1%)
	N=11			3/11 (27.3%)	7/11 (63.6%)	5/11 (45.5%)	9/11 (81.8%)	7/11 (63.6%)	8/11 (72.7%)
	N=13			2/13 (15.4%)	6/13 (46.2%)	4/13 (30.8%)	11/13 (84.6%)	4/13 (30.8%)	10/13 (76.9%)
***Citrobacter* spp.**	N=13	4/13 (30.8%)	2/6 (33.3%)	8/13 (61.5%)	11/13 (84.6%)	11/13 (84.6%)	13/13 (100.0%)	13/13 (100.0%)	13/13 (100.0%)
	N=5	2/5 (40.0%)	2/3 (33.3%)	5/5 (100.0%)	5/5 (100.0%)	5/5 (100.0%)	5/5 (100.0%)	5/5 (100.0%)	5/5 (100.0%)
***Aeromonas* spp.**	N=12			1/12 (8.3%)	10/12 (83.3%)			11/12 (91.7%)	12/12 (100.0%)
	N=7			0/7 (0.0%)	7/7 (100.0%)			7/7 (100.0%)	7/7 (100.0%)
***Pseudomonas* spp.**	N=9				9/9 (100.0%)	8/9 (88.9%)		9/9 (100.0%)	9/9(100.0%)
	N=7				7/7 (100.0%)	6/7 (85.7%)		7/7 (100.0%)	7/7 (100.0%)
	N=7				7/7 (100.0%)	7/7 (100.0%)		7/7 (100.0%)	7/7 (100.0%)
***Proteus* spp.**	N=8	5/7 (71.4%)	1/5 (20.0%)	8/8 (100.0%)	8/8 (100.0%)	8/8 (100.0%)	8/8 (100.0%)	8/8 (100.0%)	7/8 (87.5%)
	N=4	4/4 (100.0%)	1/2 (50.0%)	4/4 (100.0%)	4/4 (100.0%)	4/4 (100.0%)	4/4 (100.0%)	4/4 (100.0%)	4/4 (100.0%)

Table 3: Microbial susceptibility profile of gram-negative isolates (species with n>3)

Results

A total of 341 patients with a mean age of 63.9 ± 11.3 years were included; 202 (59.2%) were male and 137 (40.2%) had prior antibiotic receipt. For surgical ppx, patients received either cephalosporins ± metronidazole (216 [63.3%] ceftriaxone, 25 [7.3%] cefazolin), piperacillin-tazobactam (TZP) (35 [10.3%)], ciprofloxacin ± metronidazole (16 [4.7%)] or other antibiotics (14 [4.1%]), while 35 had missing data. Of the positive cultures from 84 biliary stent, 86 bile and 79 SSI, the most common organisms isolated were *Enteroccocus* spp., *E. coli*, *Klebsiella* spp., *Enterobacter* spp. and *Candida* spp.

1. Ceftriaxone susceptibility rates in *E. coli* were 50.0% (biliary stent), 54.8% (bile) and 22.2% (SSI); Rates in *Klebsiella* spp. were similarly low (Table 3).
2. Prior receipt of antibiotics may have selected for ceftriaxone-resistant *E. coli* and *Klebsiella* spp. isolated from bile cultures (70.8% vs 36.4%, p=0.019).
3. In patients with biliary stents in situ, use of TZP ppx showed a trend towards lower culture-positive SSIs compared to non-TZP ppx (9.1% vs 29.4%, p=0.054).

Conclusion

Our local gram-negative bacteria susceptibility rates to ceftriaxone are low in biliary stent, bile fluid cultures, and even lower for SSI post-PD. **Antibiotic ppx for PD in high-risk patients may need to be broadened.**