Comparative Analysis of a Polymerase Chain Reaction Infection Panel Versus Conventional Culture Techniques in Periprosthetic Joint Infection

Anzar Sarfraz[1], Garrett Ruff, Guillermo Deguzman, Daniel Waren, Guiqing Wang, Caitlin Otto, Vinh Philip Pham, Ran Schwarzkopf[2], Vinay Aggarwal
[1]NYU Langone, [2]NYU Langone Orthopedic Hospital, Hospital For Joi

INTRODUCTION:

Periprosthetic joint infection (PJI) remains one of the most challenging complications after total joint arthroplasty (TJA). While conventional culture remains the standard for identification of causative pathogens in PJI, rapid identification techniques such as polymerase chain reaction (PCR) are becoming increasingly popular with little comparative data. Our study aims to explore the efficacy of a novel PCR test compared to culture of synovial aspirates in detecting the causative organisms of PJI after TJA.

METHODS:

We conducted a retrospective review of patients suspected for PJI at a single urban academic center between December-2022 and January-2024. In total 61 patients had synovial fluid specimens collected either preoperatively or intraoperatively and sent for both fluid cultures and joint infection PCR (JIPCR). All cultures were held for 14 days until finalized. Specimens were considered positive if a causative organism was identified. Agreement between fluid culture and JIPCR tests was calculated and causative organisms were compared as well.

RESULTS:

25/61 (41%) specimens were positive by culture and 24/61 (39%) specimens were positive by JIPCR. The JIPCR panel demonstrated a positive percent agreement (PPA) of 88.0% with cultures. Of the three samples not detected by JIPCR, coagulase negative Staphylococci were the causative organisms in all three cases, and were not part of JIPCR identification panel. The JIPCR identified three additional bacterial pathogens that didn't show growth in cultures. The JIPCR demonstrated a negative percent agreement (NPA) of 94.5%. The median turnaround time (TAT) was 73 hours for positive cultures and 2 hours for JIPCR, respectively.

DISCUSSION AND CONCLUSION:

The high concordance between the JIPCR and conventional culture techniques suggests that PCR may be added as an adjunctive diagnostic tool for PJI work up after TJA. PCR's advantage of rapid turnaround time can be helpful in timely optimization of antibiotic therapy.

Table 1. Correlation table

		Joint Infection PCR (JIPCR)		Total
		Detected	Not - Detected	
Fluid Culture	Positive	22	3*	25
	Negative	2**	34	36
Total		24	37	61
JIPCR positivity: 39.34% (24/61).		Positive percent agreement (PPA): 88.0% (22/25) Negative percent agreement (NPA): 94.5% (34/36)		

* *Staphylococcus haemolyticus* (n=1), *Staphylococcus epidermidis* (n=1) and *Staphylococcus capitis* (n=1).
** *Staphylococcus aureus* (n=1) and *Streptococcus specius* (n=1).

Table 2: Joint Infection PCR Panel

Microorganism by JIPCR	Number of positive cases	% of positive JIPCR by organisms
JI STAPHYLOCOCCUS AUREUS	13 (3 MRSA)	54 %
JI STREPTOCOCCUS SPP	5	21 %
JI STREPTOCOCCUS AGALACTIAE	4	17 %
JI ESCHERICHIA COLI	1	4 %
JI FINEGOLDIA MAGNA	1	4 %
JI ANAEROCOCCUS PREV/VAG	0	0 %
JI CANDIDA ALBICANS JI ANAEROCOCCUS PREV/VAG	0	0 %
JI CANDIDA	0	0 %
JI CITROBACTER	0	0 %
JI CLOSTRIDIUM PERFRIINGENS	0	0 %
JI CUTIBACTERIUM OVIDIUM/GRAN	0	0 %
JI ENTEROBACTER CLOACAE CMP	0	0 %
JI ENTEROCOCCUS FAECALIS	0	0 %
JI ENTEROCOCCUS FAECIUM	0	0 %
JI HAEMOPHILUS INFLUENZAE	0	0 %
JI KINGELLA KINGAE	0	0 %
JI KLEBSIELLA AEROGENES	0	0 %
JI KLEBSIELLA PNEUMO GROUP	0	0 %
JI MORGANELLA MORGANII	0	0 %
JI NEISSERIA GONORRHOEAE	0	0 %
JI PARVIMONAS MICRA	0	0 %
JI PEPTONIPHILUS	0	0 %
JI PEPTORSTREPTOCOCCUS ANA	0	0 %
JI PROTEUS SPP.	0	0 %
JI PSEUDOMONAS AERUGINOSA	0	0 %
JI SALMONELLA SPP.	0	0 %
JI SERRATIA MARCESCENS	0	0 %
JI STAPHYLOCOCCUS LUGDUNESIS	0	0 %
JI STREPTOCOCCUS PNEUMONIAE	0	0 %
JI STREPTOCOCCUS PYOGENES	0	0 %
Total PCR positive	**24**	
Total noumber of specimens	**61**	

JIPCR, joint infection polymerase chain reaction; PCR, polymerase chain reaction.