What is the actual broadness of the universal panbacterial PCR in diagnostics of infections?

J. Tkadlec[1], M. Antušková[1], D. Jahoda[2], L. Šrámková[3], V. Rohn[4], M. Kvapil[5], D. Raszka[2], P. Dřevínek[1]

[1] Department of Medical Microbiology, 2nd Faculty of Medicine,
[2] 1st Department of Orthopaedics, 1st Faculty of Medicine,
[3] Department of Paediatric Haematology and Oncology, 2nd Faculty of Medicine,
[4] Department of Cardiovascular Surgery, 2nd Faculty of Medicine,
[5] Department of Internal Medicine, 2nd Faculty of Medicine, Charles University and Motol University Hospital, Prague CZECH REPUBLIC

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jan.tkadlec@lfmotol.cuni.cz

BACKGROUND

A complementary use of molecular genetic methods in detecting bacterial agents is particularly beneficial in situations where culture based approach fails due to: 1/ its low sensitivity, 2/ the presence of fastidious or unculturable bacteria in the sample, 3/ an ongoing antibiotic therapy or 4/ where it implicits a critical time delay to get a result. While species specific PCRs are designed to identify a unique DNA sequence of single pathogens, broad spectrum molecular assays enable to search through a common DNA region for virtually any bacterial species in the specimens. We aimed to evaluate the usefulness and clinical relevance of the latter approach which we applied to various microbiological materials collected from primary sterile sites.

MATERIAL/METHODS

Surgically removed heart valves because of suspected infectious endocarditis (IE), orthopaedic samples (ORT; joint punctures or tissue samples), blood samples of children with haematological disorders (HD BSI) and blood samples of internal medicine patients (INT BSI) were simultaneously subjected to culture based methods and universal panbacterial PCR (UMD SelectNA, Molzym, Germany).

Samples for panbacterial PCR were prepared according to the protocol suplied by the manufacturer.

Table 1: Added value of the PCR in diagnostics:

		PCR/Culture +/+ same	-/- same	+/+ diff.	+/-	-/+	Total
IE		4	7	1	25	0	37
Added value of PCR:	Newly identified agens				15		25
	Persistent result			1	9		
No added value of PCR:	Same as culture	4	7				12
	Newly identified agens - unlikely				1		
ORT		45	67	4	39	7	162
Added value of PCR:	Newly identified agens			3	18		38
	Persistent result				11		
	Confirmed negativity		6				
No added value of PCR:	Same as culture	45	59				124
	Newly identified agens - unlikely				9		
	Failed detection		2	1	1	7	
HD BSI		8	120	6	28	14	176
Added value of PCR:	Newly identified agens-certain						20
	Newly identified agens-probable			1	10		
	Newly identified agens-possible			1	8		
No added value of PCR:	Same as culture	8	120				156
	Newly identified agens - unlikely				10		
	Failed detection			2		4	
	Failed detection- probable			2		4	
	Failed detection - possible					6	
INT BSI		18	51	6	10	2	87
Added value of PCR:	Newly identified agens-certain						10
	Newly identified agens-probable				2		
	Newly identified agens-possible				4		
	Persistent result			1	3		
No added value of PCR:	Same as culture	18	51				77
	Newly identified agens -unlikely				1		
	Failed detection			5		2	

RESULTS

From October 2013 to March 2016, total of 462 samples were examined by the universal panbacterial PCR. Each PCR result was compared to the culture and categorised as: i) positive or ii) negative consensus (+/+; -/-, respectively); iii) different result of PCR and culture (+/+ diff.); iv) PCR positive/culture negative (+/-); v) PCR negative/culture positive (-/+).

PCR result was considered as beneficial (added value) when: A/clinically relevant agens was detected only by PCR (Newly identified agens - in case of BSI subdivided as Certain, Probable or Possible according to their clinical relevance); B/clinically relevant agens repeatedly detected only by PCR (Persistent result); or C/negativity after the treatment confirmed by PCR (Confirmed negativity).

PCR result was considered as unimportant (no added value) when: A/agens detected by PCR as well as culture (Same as culture); B/clinically irrelevant agens detected by PCR (Newly identified agens – unlikely); C/PCR failed to detected clinically relevant agens detected by culture (Failed detection – when possible subdivided as possible and probable according to the clinical relevance of culture result).

Sensitivity, specificity, positive (PPV) and negative predictive value (NPV) of the PCR was calculated using culture as standard (Table 2).

Table 2.	Sensitivity	Specificity	PPV	NPV
IE	1,000	0,219	0,167	1,000
ORT	0,849	0,615	0,517	0,893
HD Blood	0,308	0,800	0,211	0,870
INT Blood	0,720	0,823	0,621	0,879

CONCLUSION

We evaluated in clinical practice use of the commercional panbacterial PCR detection method (UMD SelectNA, Molzym, Germany). Sensitivity of PCR, when calculated using culture result as a standard, was strongly influenced by the superiority of PCR in detection of bacterial agens. Especially in case of suspected HD BSI results of PCR and culture differ significantly.

Method of panbacterial PCR detection can increase a recovery rate, but its meaningful indication as well as interpretation are strictly linked to a type of clinical material under investigation. While it proved to be desirable part or routine microbiological examination for IE and joint infections, false negative results makes it questionable in diagnostics of the BSI. The potential of PCR in BSI can be envisaged in its high NPV as observed especially in the group of adults with suspected BSI.

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