Surgical Management of Contegra Infective Endocarditis

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Contegra Infective Endocarditis

(Interact Cardiovasc Thorac Surg 2022, DH Kim et al)

Risk factors for early adverse outcomes after bovine jugular vein conduit implantation: influence of oversized conduit on the outcomes

Dong-Hee Kim, Young Kern Kwon, Eun Seok Choi, Bo Sang Kwon, Chun Soo Park and Tae-Jin Yun *

Abstract

OBJECTIVES: We investigated potential risk factors for early failure of bovine jugular vein conduit (Contegra®) implantation for right ventricular outflow tract (RVOT) reconstruction.

METHODS: A single-centre retrospective review of 115 consecutive patients (54 males) who underwent RVOT reconstruction with Contegra between 2016 and 2019 was performed. Overall survival, explantation-free survival and freedom from significant RVOT lesions (valve regurgitation ≥ moderate or flow velocity ≥3.5 m/s) were investigated.

RESULTS: Median age, body weight and Contegra diameter were 10.3 months [interquartile range (IQR) 5.7–26.9 months], 7.8 kg (IQR 6.3–12.4 kg) and 14 mm (IQR 12–16 mm), respectively. During the median follow-up duration of 25.1 months, there were 7 deaths, 34 significant RVOT lesions, 10 endocarditis episodes and 15 explantations. Overall survival and explantation-free survival at 3 years were 94.8% and 78.4%, respectively. Significant RVOT lesions ($n = 34$) comprised 20 stenoses, 8 regurgitations and 6 combined lesions. Freedom from significant RVOT lesions at 3 years was 62.6%. Cox regression identified higher indexed Contegra size (Contegra diameter/body weight, mm/kg) as the only risk factor for decreased time to explantation or death (hazard ratio 2.32, $P < 0.001$) and time to significant RVOT lesions development (hazard ratio 2.75, $P < 0.001$). The cut-off value of indexed Contegra size for significant RVOT lesions at 12 months was 1.905 mm/kg (sensitivity, 0.75; specificity, 0.78; area under the curve, 0.82).

CONCLUSIONS: Outcomes of RVOT reconstruction using Contegra were acceptable. However, oversized Contegra should be avoided when possible.

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Table 3: Result of Cox proportional hazards ratio analysis for development of significant right ventricular outflow tract lesions

	Univariable			Multivariable		
	HR	95% CI for HR	*P*-value	HR	95% CI for HR	*P*-value
Male sex	1.84	0.92–3.67	0.085	NA[c]		
Age (months)	0.98	0.96–1.00	0.038	NA[c]		
Body weight (kg)	0.90	0.82–0.98	0.020	NA[c]		
BSA (m^2)	0.030	0.002–0.39	0.008	NA[c]		
Primary diagnosis						
TOF or its variants[a]	0.72	0.33–1.60	0.42			
With MAPCA	0.78	0.24–2.55	0.68			
With absent pulmonary valve syndrome	1.22	0.29–5.08	0.79			
Truncus arteriosus	3.94	1.70–9.12	0.001	NA[c]		
Aortic stenosis (with Ross procedure)	NA		1.00			
Transposition of great arteries	1.17	0.16–8.65	0.88			
Other	NA		1.00			
Confluent pulmonary artery with normal arbourization	0.53	0.27–1.06	0.072	NA[c]		
History of previous cardiac operation	0.22	0.11–0.44	<0.001	NA[c]		
Genetic anomaly	0.71	0.17–2.95	0.63			
McGoon ratio	0.60	0.33–1.09	0.093	NA[c]		
Pulmonary artery index (mm^2/m^2)	1.00	0.99–1.00	0.52			
Conduit diameter/body weight at operation (mm/kg)	2.76	1.98–3.84	<0.001	2.75	1.97–3.84	<0.001
Conduit diameter (Z-score)[b]	1.82	1.02–3.27	0.043	NA[d]		
Dual RVOT pathway	1.21	0.43–3.43	0.72			
One-and-a-half ventricular repair	0.60	0.14–2.50	0.48			
PA arterioplasty upon Contegra implantation	0.88	0.45–1.73	0.71			
CPB time (min)	1.00	0.99–1.00	0.44			

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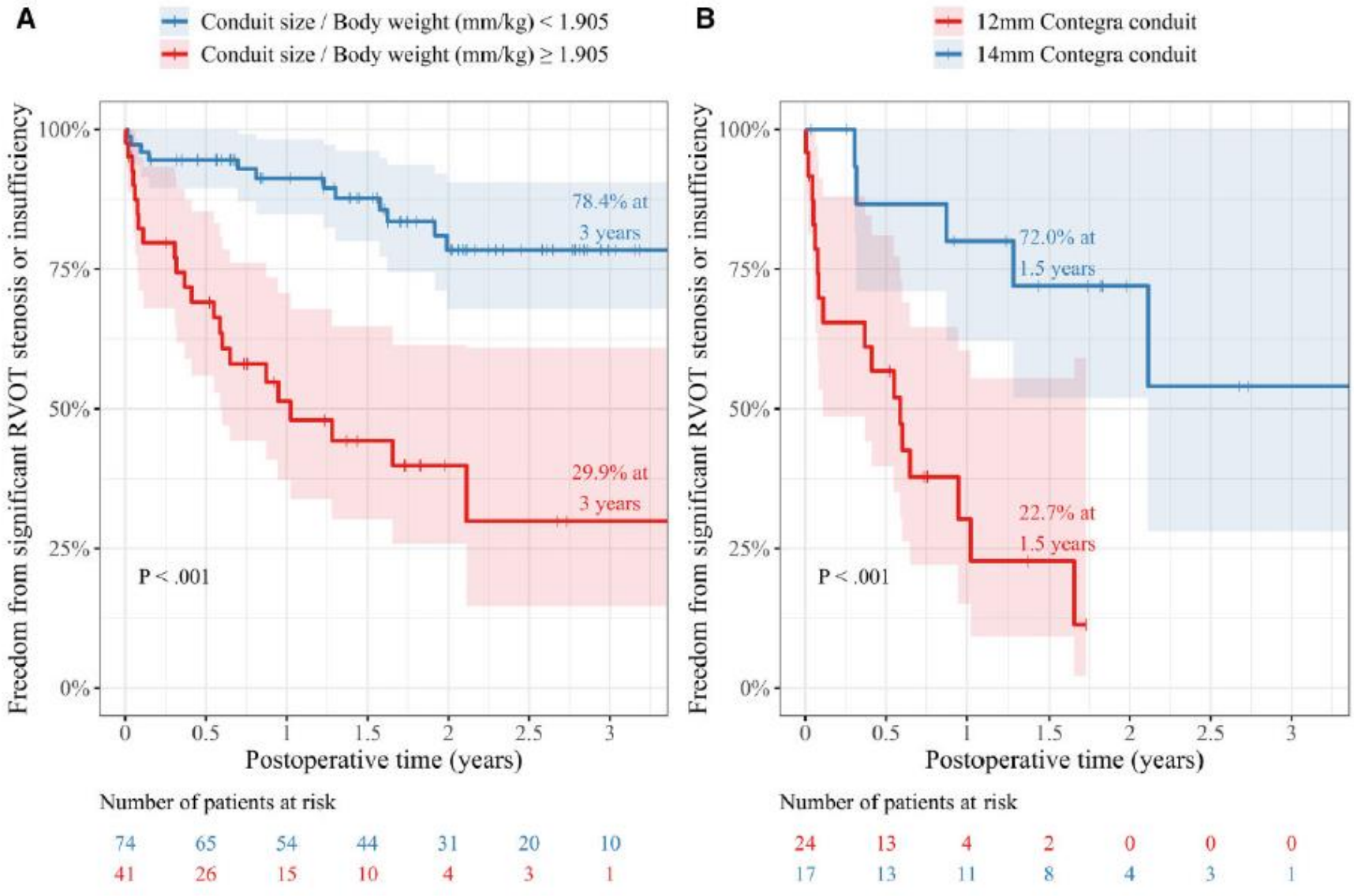

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Infective endocarditis in the Contegra conduit

Ten patients (10/115, 8.7%) developed infective endocarditis within the Contegra conduit: 8 patients with definite endocarditis and 2 patients with possible endocarditis, based on the modified Duke criteria [18]. The median duration from Contegra implantation to the development of infective endocarditis was 385 days (IQR 171–746 days) in the 8 patients diagnosed with definite endocarditis. All patients with definite endocarditis had vegetations on the Contegra valve, and additional vegetations were observed at the right pulmonary artery ($n = 1$), the left pulmonary artery ($n = 1$) and a patch used for ventricular septal defect closure ($n = 1$). Two patients with possible endocarditis and another 4 patients with definite endocarditis were successfully treated with antibiotics, while Contegra explantation was required for the remaining 4 patients due to severe stenosis in the conduit *per se*.

Contegra Infective Endocarditis

(AMC experience, 2016-2024)

- Duration: April 2016-February 2024
- 235 Contegra implantation in 207 patients
- Mortality: 9/207 (4.3 %) **(IE-related: 1/9)**
- Median F/U: 43.4 months (IQR: 16.2-67.1 m)
- Contegra Explantation: 47/235 (20%) **(IE-related: 11/47)**
- Contegra Infective Endocarditis (IE): 13/235 (5.5%)
- Contegra IE incidence: **0.87 per 100 patient-years**

Contegra Infective Endocarditis

(AMC experience, 2016-2024)

No.	sex	Dx	Age at Contegra implant	Contegra ∅	∅ / Bwt	Organism	Contegra Explant	Survival
1	F	PA, VSD	11 m	14 mm	1.75	G (+) cocci*	O	O
2	F	Truncus	9 d	12 mm	4.18	G (+) cocci	O	O
3	M	DORV (Fallot)	9 y	18 mm	0.67	G (+) cocci**	O	O
4	M	PA,VSD,MAPCA	9 d	12 mm	3.21	Fungus	X	X
5	M	PA,VSD	5.5 m	14 mm	1.57	G (+) cocci	O	O
6	F	PA,VSD	6.7 m	12 mm	1.90	G (+) rod	O	O
7	M	PA,VSD	8.1 m	14 mm	2.00	G (+) cocci	O	O
8	M	PA,VSD	8.9 m	14 mm	2.22	G (+) rod	O	O
9	F	IAA, VSD,LVOTO	14.9 m	14 mm	1.97	G (+) cocci*	O	O
10	F	Truncus	3 y	16 mm	1.19	G (+) cocci	O	O
11	M	DORV (Fallot)	7.1 m	12 mm	1.99	G (+) cocci*	O	O
12	M	PA,VSD,MAPCA	4 y	16 mm	1.11	unknown	O	O
13	M	PA with VSD	7.8 m	14 mm	1.63	G (+) cocci**	X	O

* S.epidermidis ** S.aureus

Contegra Infective Endocarditis

(AMC experience, 2016-2024)

No.	Contegra Explant	PSR	Implant-Explant	IE locus	Conduit change on active IE	2nd Conduit
1	O	Psr	46 m	Valve leaflet(s)	O	PTFE conduit
2	O	PS dominant	92 m	Valve leaflet(s)	X	Contegra
3	O	PS dominant	2 m	Valve leaflet(s)	O	Hancock valved conduit
4	X	PR dominant	•	Valve leaflet(s)	•	•
5	O	PS dominant	87 m	Valve leaflet(s)	X	Contegra
6	O	Psr	31 m	Valve leaflet(s)	O	PTFE conduit
7	O	PS dominant	16 m	Valve leaflet(s)	O	PTFE conduit
8	O	PS dominant	81 m	Valve leaflet(s)	O	Contegra
9	O	Psr	11 m	Yasui Baffle leak point	O	PTFE conduit
10	O	Psr	52 m	Valve leaflet(s), LPA	X	Contegra
11	O	PS dominant	7 m	Valve leaflet(s)	O	PTFE conduit
12	O	Unknown	33 m	unknown	O	Unknown
13	X	Psr	•	Valve leaflet(s)	•	•

Antiplatelet therapy abrogates platelet-assisted Staphylococcus aureus infectivity of biological heart valve conduits

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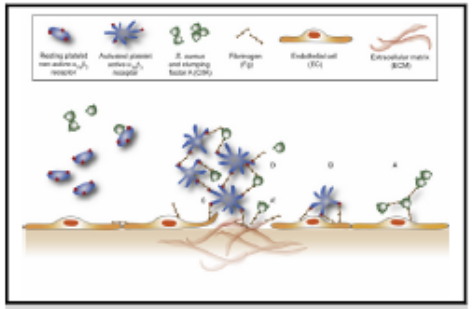
ABSTRACT

Objective: Although recent advances in pulmonary valve replacement have enabled excellent hemodynamics, infective endocarditis remains a serious complication, particularly for implanted bovine jugular vein (BJV) conduits.

Methods: We investigated contributions by platelets and plasma fibrinogen to endocarditis initiation on various grafts used for valve replacement. Thus, adherence of *Staphylococcus aureus* and platelets to 5 graft tissues was studied quantitatively in perfusion chambers, assisted by microscopic analysis. We also evaluated standard antiplatelet therapy to prevent onset of *S aureus* endocarditis.

Results: Of all tissues, bovine pericardium (BP) showed the greatest fibrinogen binding. Perfusion of all plasma-precoated tissues identified BP and BJV_{wall} with the greatest affinity for *S aureus*. Perfusions of anticoagulated human blood over all tissues also triggered more platelet adhesion to BP and BJV_{wall} as single platelets. Several controls confirmed that both *S aureus* and platelets were recruited on immobilized fibrinogen. In addition, perfusions (and controls) over plasma-coated tissues with whole blood, spiked with *S aureus*, revealed that bacteria exclusively bound to adhered platelets. Both the platelet adhesion and platelet-mediated *S aureus* recruitment required platelet $\alpha_{IIb}\beta_3$ and coated or soluble fibrinogen, respectively, interactions abrogated by the $\alpha_{IIb}\beta_3$-antagonist eptifibatide. Also, standard antiplatelet therapy (aspirin/ticagrelor) reduced the adherence of *S aureus* in blood to BJV 3-fold.

Conclusions: Binding of plasma fibrinogen to especially BJV grafts enables adhesion of single platelets via $\alpha_{IIb}\beta_3$. *S aureus* then attaches from blood to (activated) bound platelet $\alpha_{IIb}\beta_3$ via plasma fibrinogen. Dual antiplatelet therapy appears a realistic approach to prevent endocarditis and its associated mortality. (J Thorac Cardiovasc Surg 2021;161:e457-72)



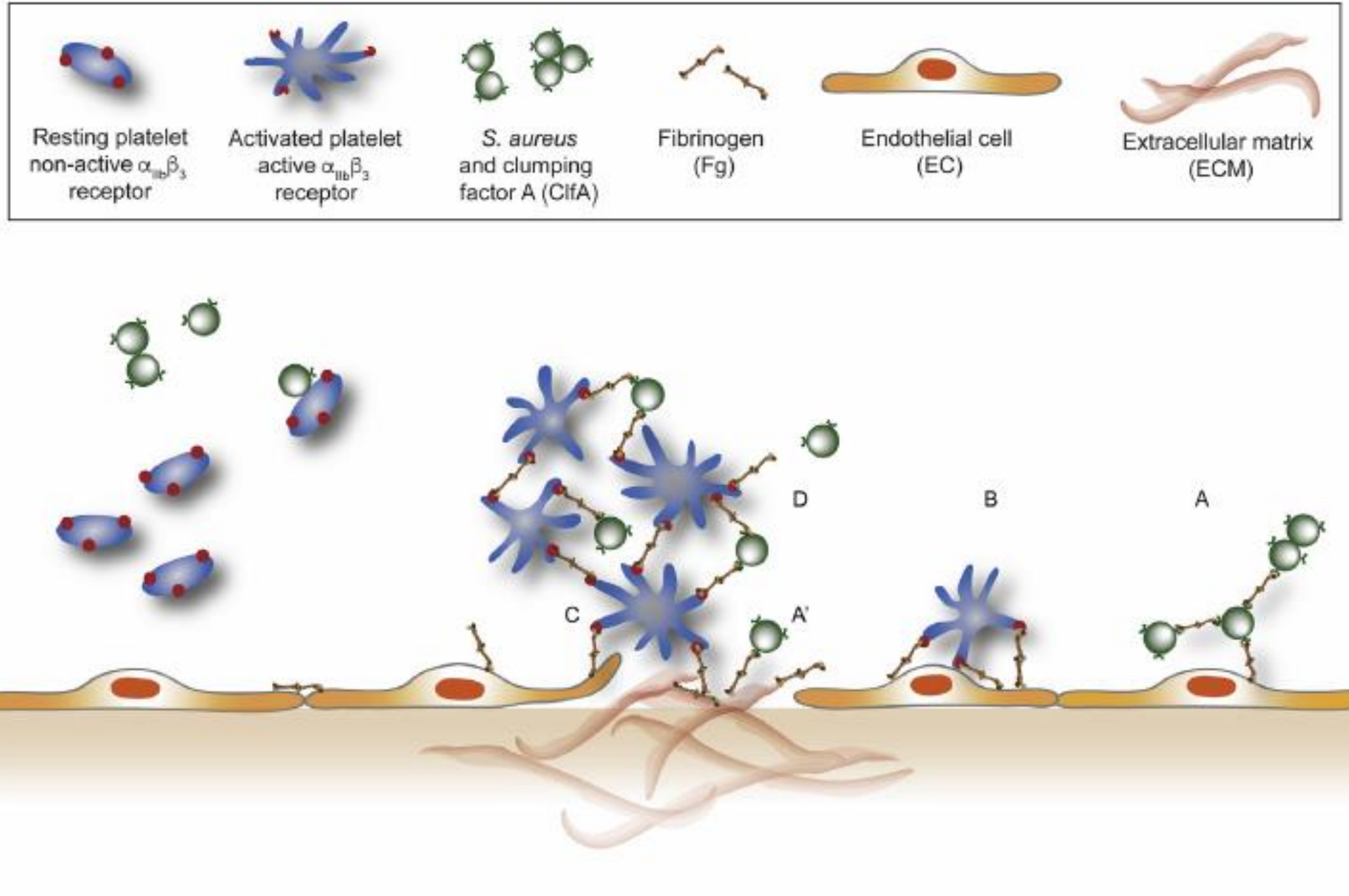
Platelets recruit bacteria via bridging integrin $\alpha_{IIb}\beta_3$ and bacterial ClfA using Fg.

CENTRAL MESSAGE

In the onset of infective endocarditis on heart valve conduits, single platelets adhere to biological heart valve conduit tissues upon fibrinogen coating and recruit bacteria via platelet integrin $\alpha_{IIb}\beta_3$ and plasma fibrinogen.

PERSPECTIVE

Infective endocarditis is an underestimated, highly lethal disease, the prevalence of which is rapidly increasing as a consequence of medicosurgical interventions. Results provide a strong rationale that antiplatelet agents may be beneficial in the


Resting platelet non-active $\alpha_{IIb}\beta_3$ receptor
Activated platelet active $\alpha_{IIb}\beta_3$ receptor
S. aureus and clumping factor A (ClfA)
Fibrinogen (Fg)
Endothelial cell (EC)
Extracellular matrix (ECM)
A
B
C
D
A'

Contegra Infective Endocarditis

-Take-home messages-

- Development of Contegra graft IE is not infrequently.

  (Incidence: 0.87 per 100 patient-years from AMC experience)

- Valve leaflets are the most frequently affected locus of IE.

- Use of anti-platelet agent may prevent the development of IE.