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The prevalence of alloantibodies and ABO RhD blood groups in a cohort of Aboriginal and non-Aboriginal cardiac surgery patients from Australia

Romi Sinha [a,*], Robert A. Baker [a,b], Tina Noutsos [a,c,d], Maree Perry [e,f], David Roxby [a]

[a] College of Medicine and Public Health, Flinders University, Adelaide, SA, Australia
[b] Cardiac and Thoracic Surgery Unit, Flinders Medical Centre, South Australia, Australia
[c] Menzies School of Health Research, Charles Darwin University, Darwin, Northern Territory, Australia
[d] Department of Haematology, Royal Darwin Hospital, Darwin, Northern Territory, Australia
[e] Queensland University of Technology, Brisbane, Queensland, Australia
[f] Faculty of Medicine, Dentistry and Health Sciences, University of Melbourne, Melbourne, VIC, Australia

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ABSTRACT

Introduction: Limited evidence exists on the distribution of ABO RhD blood groups and prevalence and specificity of red blood cell (RBC) alloantibodies in Aboriginal and Torres Strait Islander peoples of Australia. We investigated RBC alloantibody prevalence and ABO RhD groups in Aboriginal patients undergoing cardiac surgery at a South Australian (SA) tertiary hospital, a major cardiac surgical referral centre for Northern Territory (NT) patients

Methods: Retrospective analysis of all consecutive patients undergoing cardiac surgery at Flinders Medical Centre (FMC) between January 2014 and June 2019. ABO and RhD blood groups, and RBC alloantibody prevalence, specificity, and clinical significance in Aboriginal and non-Aboriginal cardiac patients were determined at time of surgery and on follow up to 2021.

Results: 2327 patients were included, 588 (25.3 %) were from NT, and 420 (18.0 %) were Aboriginal. Aboriginal patients had a higher prevalence of ABO group O (59.8 % vs 43.9 %) and RhD positive (99.0 % vs 83.8 %). One-hundred-and-eleven patients had 154 RBC alloantibodies, 57/420 (13.6 %) Aboriginal versus 54/1907 (2.8 %) non-Aboriginal ($p < 0.0001$). There were higher numbers of IgM alloantibodies in Aboriginal patients (59/77, 76.6 %), with Lewis, P1 and M more common. Sixty patients had antibodies detected at time of surgery, 14 NT patients with previously detected alloantibodies, prior to surgery, presented with a negative antibody screen and 37 had new antibodies detected after cardiac surgery.

Conclusion: A high prevalence of IgM alloantibodies was found in Aboriginal compared to non-Aboriginal cardiac surgery patients. The clinical significance of these IgM alloantibodies in Aboriginal peoples requires further investigation.

1. Introduction

Aboriginal and Torres Strait Islander peoples make up 3.3 % of the overall Australian population, 2.5 % of the South Australian population, and 30.3 % of the Northern Territory's (NT) population. Aboriginal peoples of the NT are a culturally, linguistically, and genetically rich and diverse peoples [1–3]. More than 75 % of Aboriginal people in the NT reside in remote communities [4]. In the setting of unmet health and welfare needs, Aboriginal peoples have high rates of cardiovascular disease, with remote NT Aboriginal communities reporting some of the highest rates of post-streptococcal acute rheumatic fever and subsequent rheumatic heart disease in the world [5]. A subset of patients with rheumatic heart disease requires cardiothoracic surgery, including cardiac valve repair and/or replacement. Between 2016–2020, 95 % of patients from the NT undergoing surgery for rheumatic heart disease were Aboriginal [5].

Cardiac surgery is associated with high rates of red blood cell (RBC) transfusion support, and there are limited published data on the prevalence and specificity of RBC alloantibodies found in Aboriginal patients [6,7]. RBC alloantibodies can form due to exposure to foreign RBC antigens during transfusion, in which case they are typically clinically significant, IgG type and active at 37 °C. Such clinically significant

* Correspondence to: College of Medicine & Public Health, Flinders University, Bedford Park 5042, South Australia, Australia.
E-mail address: romi.sinha@flinders.edu.au (R. Sinha).

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alloantibodies pose a risk of acute or delayed haemolytic transfusion reactions and haemolytic disease of the fetus and newborn (HDFN) in pregnant women if re-exposed to the corresponding RBC antigen. The presence of clinically significant alloantibodies usually necessitates finding antigen-negative donor blood for transfusion. Even non-clinically significant alloantibodies, which are typically IgM type and generally most active at lower thermal amplitudes below 37 °C, can lead to delays in finding crossmatch compatible blood for future blood transfusions.

There is existing evidence that the distribution of Aboriginal blood group antigens, including but not limited to ABO RhD blood groups, differ from non-Aboriginal Australian blood groups and, the predominantly Caucasian Australian blood donor pool [6–8]. With respect to ABO groups, group O is the most common blood group in Aboriginal communities in Northern Australia, such as Cape York, the Northern region and Kimberley. Group A is the second most common blood group in the Aboriginal community, mainly in Central Australia, whereas groups B and AB are uncommon [6]. RhD negative Aboriginal Australians have been rarely reported, with the majority being RhD positive [6]. A recent study demonstrated a high O blood group and RhD positive distribution among patients admitted to six public hospitals in the NT [8]. Much smaller studies have shown differences in other RBC blood groups which are associated with alloantibody formation [9,10], but data on the prevalence and specificity of alloantibodies in Aboriginal patients is lacking. Blood group antigens being genetically determined, demonstrate a unique genetic diversity within Aboriginal peoples of Australia [1–3]. However, this diversity also poses risk for Aboriginal patients potentially needing a red cell transfusion, who therefore theoretically have a higher chance of alloimmunisation if transfused, in the context of Australia's blood donor pool being predominantly Caucasian.

Understanding the frequency and distribution of RBC alloantibodies and blood groups in Aboriginal patients is critical in managing optimal blood donor recruitment, blood supply planning, RBC inventory management, in reducing wastage, and better understanding risks of transfusion and patient informed consent.

Flinders Medical Centre's Cardiac and Thoracic Surgery Unit in Adelaide is an important referral centre for NT residents requiring cardiothoracic surgery, in addition to South Australian metropolitan, rural and remote populations. We undertook a multijurisdictional study of all cardiothoracic surgical patients admitted at Flinders Medical Centre with the aim of determining the prevalence and specificity of RBC alloantibodies and ABO RhD blood group frequencies in Aboriginal and non-Aboriginal cardiac surgery patients.

2. Materials and methods

A retrospective cohort study analysis of 2327 patients who underwent cardiac surgery between January 2014 and June 2019 at Flinders Medical Centre, South Australia was undertaken. The study has ethics approval from the Southern Adelaide Clinical Human ReseaRBCh Ethics Committee (HREC) (LNR/21/SAC/78), Aboriginal Health Council of South Australia Inc Aboriginal Health ReseaRBCh Ethics Committee (AHREC Protocol#: 04–22-927), and Northern Territory Department of Health and Menzies School of Health ReseaRBCh HREC (2020–3930).

The term 'Aboriginal' is used respectfully throughout this paper as inclusive of people who identify as First Nations, Aboriginal, Torres Strait Islander or both Aboriginal and Torres Strait Islander peoples and cultures.

Patients undergoing cardiac artery bypass graft (CABG), or valve procedures were identified from the SA Blood Utilisation Database using the Australian modification of the International Statistical Classification of Diseases (ICD 10 AM). This Utilisation Database links SA Public hospitals with transfusion and pathology datasets from the state-wide public pathology service. The data linkage methodology is described elsewhere [11].

Patient demographic data included age, sex, and Aboriginal status. Laboratory data were extracted from the SA Pathology Transfusion database and the NT-wide Territory Pathology Laboratory Information System (LIS), including ABO & RhD blood group, date of alloantibody detection, alloantibody, and antigen specificities.

Patients who had alloantibodies were further investigated for the timing of antibody detection, first date when it was detected, and whether the alloantibodies were present at the time of the index cardiac surgery or no longer detectable (antibody evanescence) or whether newly identified alloantibodies had developed following cardiac surgery.

For patients with a primary place of residence in the NT, alloantibody detection and specificity over the time in both NT and SA sites was also longitudinally tracked over time. All red cell alloantibodies detected before, after, and at the time of surgery were included in the analysis. Auto-antibodies and HLA antibodies were excluded from the analysis.

All antibody screening tests during the study period were performed using a three-cell screen and an indirect antiglobulin technique with column agglutination technology (BioVue, Ortho Clinical Diagnostics, Mulgrave, Victoria, or ID-Card, Bio-Rad, South Granville, New South Wales). Samples that tested positive on the antibody screen were subjected to antibody identification using 11 cell panel investigations (BioVue, Ortho Diagnostics or ID-Card, Bio-Rad).

Baseline variables were summarised using descriptive statistics. A p-value < 0.05 was considered significant. Analysis was performed using IBM SPSS version 27. A heatmap was created to examine the incidence of alloantibodies in Aboriginal versus non-Aboriginal patients.

3. Results

There were 2339 cardiac surgery admissions, including 1178 CABG, 1029 cardiac valves, and 132 other surgeries during the study period. 2327 patients were included in the analysis, with 12 patients excluded due to missing procedure details and comorbidities. The cohort included 420 Aboriginal and 1907 non-Aboriginal patients. Fig. 1 summarises Aboriginal and non-Aboriginal patients including patients from the NT and SA.

The distribution of ABO groups between the Aboriginal and non-Aboriginal patients was significantly different. The commonest blood groups in both patient groups were O and A; the distribution of ABO groups was 59.8 % for O, and 36.9 % for A for Aboriginal patients; and for non-Aboriginal patients, it was 43.9 % for O and 42.6 % for A (Table 2). The distribution of ABO RhD groups in Aboriginal patients was 59.3 % for O RhD positive and 36.4 % for A RhD positive; for non-Aboriginal patients, it was 36.3 % for O RhD positive and 35.7 % for A RhD positive (Table 2).

The overall proportion of patients who were RhD negative was significantly lower in Aboriginal than non-Aboriginal patients, 1.0 % vs 16.2 %, $p < 0.001$ (Table 2). It was also significantly lower in patients from NT than SA 4.4 % vs 16.4 %, $p < 0.001$ which was attributable to the high proportion of Aboriginal patients from NT (Fig. 1).

111 patients (111/2327, 4.8 %) had RBC alloantibodies detected. Table 1 compares the patient and surgery characteristics between the patients who had RBC alloantibodies and who did not have RBC alloantibodies. There was a significant difference in the number of RBC alloantibodies in Aboriginal cardiac surgery patients (57/420, 13.6 %) compared to non-Aboriginal patients (54/1907, 2.8 %) ($p < 0.001$). Of the 111 patients, 74 patients had pre-existing alloantibodies, of which 60 patients had alloantibodies detected at the time of surgery, whilst 37 patients had newly identified antibodies detected when followed up after cardiac surgery.

A total of 154 alloantibodies were detected in the 111 patients, with 77 alloantibodies in both the Aboriginal and non-Aboriginal groups. These are summarised in the heatmap (Fig. 2). The most frequently identified antibodies were in the following blood group systems: Rhesus (Rh) (48/154, 31.2 %), Lewis (45/154, 29.2 %), Kell (23/154, 14.9 %) and MNS (19/154, 12.3 %) (Table 2). Alloantibodies to the Lewis and

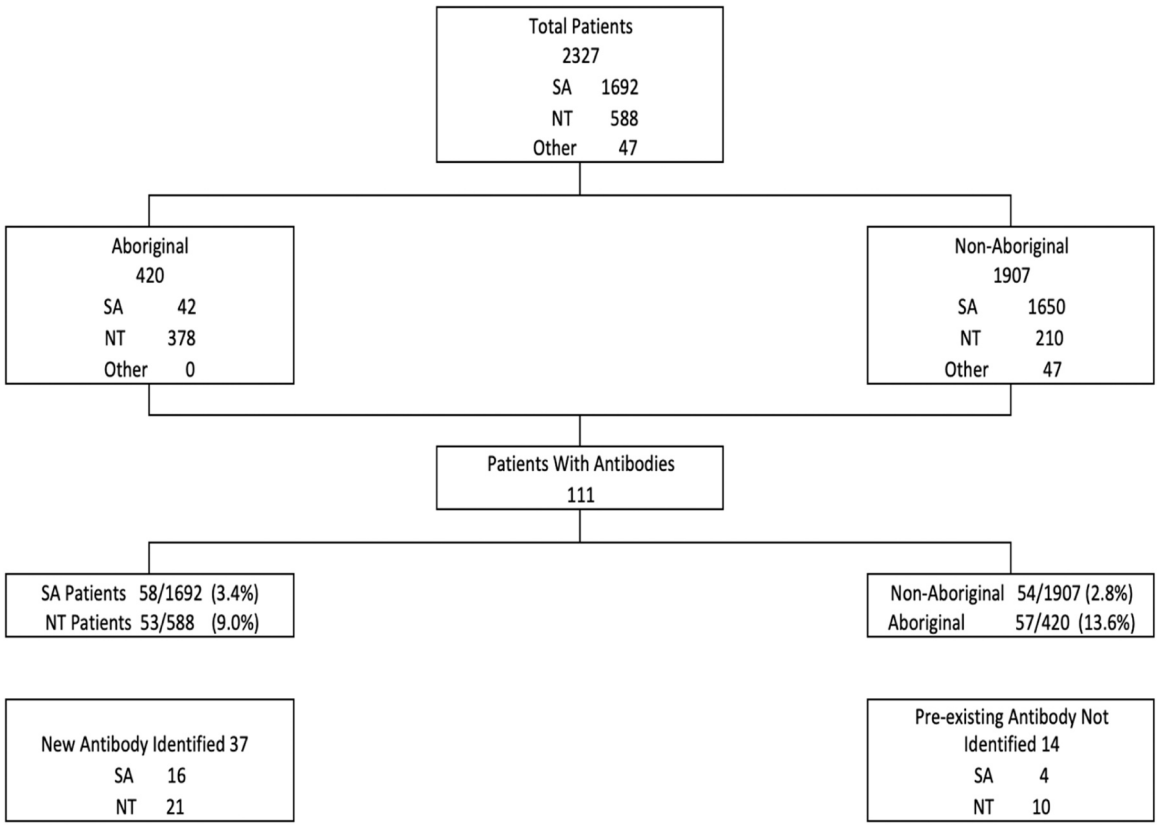

Fig. 1. Summary of patients based on residence, ethnicity, and alloantibodies.

Table 1
Characteristics of the South Australian and Northern Territory cardiac surgery patient population.

Patient Characteristics	Total (n = 2327)	Alloantiody positive (n = 111)	Alloantibody Negative (n = 2216)	p value
Age in years (Median, IQR)	66 (55-75)	57 (44-72)	66 (56-75)	< 0.001
Female sex	674 (29.0 %)	59 (53.2 %)	615 (27.9 %)	< 0.001
Aboriginal	420 (18.0 %)	57 (51.3 %)	363 (16.4 %)	< 0.001
Type 2 Diabetes	758 (32.6 %)	42 (37.8 %)	716 (32.3 %)	0.33
Renal Disease	295 (12.7 %)	21 (18.9 %)	274 (12.4 %)	0.04
Rheumatic Heart Disease	233 (10.0 %)	12 (10.8 %)	221 (10.0 %)	0.77
Emergency/ Urgent surgery	468 (20.1 %)	19 (17.1 %)	449 (20.3 %)	0.42
EuroScore II	3.6 (1.9-7.1)	2.5 (1.3- 3.9)	1.6 (0.9-3.5)	< 0.001
Type of surgery				0.05
CABG	1179 (50.7 %)	43 (38.7 %)	1136 (51.3 %)	
Valve	946 (40.6 %)	54 (48.6 %)	892 (40.3 %)	
Valve/CABG	194 (8.3 %)	13 (11.7 %)	181 (8.2 %)	
Other	8 (0.4 %)	1 (0.9 %)	7 (0.3 %)	

SA: South Australia. NT: Northern Territory. CABG: Coronary artery bypass graft

MNS blood group systems were more commonly found in Aboriginal patients, whereas alloantibodies to the Rh and Kell blood group systems were more commonly found in non-Aboriginal patients (Table 2).

Within the Rh system, the identified alloantibodies included anti–E (23/48, 47.9 %), anti-D (10/48, 20.8 %), anti-C (6/48, 12.5 %), anti-c (5/48, 10.4 %) and anti-e (1/48, 2.1 %) (Table 4). Within the Lewis and MNS Systems, the identified alloantibodies included Lea (29/45, 64.4 %), Leb (16/45, 35.6 %) and anti- M (16/19, 84.2 %), respectively (Table 2).

A higher number of IgM alloantibodies (M, N, P1, Lea and Leb) were found in Aboriginal patients who developed antibodies (59, 76.6 %), compared to (9, 11.7 %) in non-Aboriginal patients ($p < 0.001$). In Aboriginal patients these IgM alloantibodies included Lewis (55.8 %), MN (14.3 %) and P1 (6.5 %) (Table 2). Only 23 % of the alloantibodies were IgG (Rh, Kell, Duffy and Kidd) in Aboriginal patients compared to 88 %, $p < 0.001$ in non-Aboriginal patients who developed antibodies (Table 2).

Of the 154 antibodies, 84 (54.5 %) were present in 60 patients at the time of the surgery, the remaining 70 antibodies were not detected during surgery, 52 (33.7 %) were new alloantibodies detected over the follow-up period in 37 patients. These antibodies included Rhesus (22), Kell (11), MNS (8), and Lewis (8) blood group systems (Table 4). There were 18 pre-existing antibodies in 14 NT patients detected in NT laboratories, which were later undetectable at the time of admission for cardiac surgery and pre-transfusion testing and antibody screening in SA. These alloantibodies included Rhesus (3, 15.8 %), Kell (4, 21.1 %), Kidd (1, 5.6 %), MNS (1, 5.3 %), P1 (2, 10.5 %) and Lewis (7, 36.8 %), (Table 4).

4. Discussion/conclusion

This is the first large cohort study to report the expression of alloantibodies in Aboriginal patients undergoing cardiac surgery. Alloantibodies were found in 4.8 % of the total cardiac surgery patients, 13.6 % of Aboriginal patients and 2.8 % of non-Aboriginal patients, comparable with a recent study where the rate was 10.9 % vs 2.3 % in Aboriginal versus non-Aboriginal patients admitted to intensive care units [12]. These antibodies were either RBC immune (IgG) or non-RBC immune

Table 2
ABO and RhD distribution for Aboriginal and non-Aboriginal patients undergoing cardiac surgery.

	Our Study			Comparitive studies	
	Aboriginal (n = 420)	non-Aboriginal (n = 1907)	p value	non-Aboriginal (n = 1318,751) *	First-time blood donors 1993-94[a]
ABO Blood Group			< 0.001		
O	251 (59.8 %)	837 (43.9 %)		505,852 (38.4 %)	40 % 9 %
O RhD positive	249 (59.3 %)	693 (36.3 %)		85,384 (6.5 %)	
O RhD negative	2 (0.5 %)	144 (7.6 %)			
A	155 (36.9 %)	812 (42.6 %)		422,160 (32 %) 73,242 (5.6 %)	31 % 7 %
A RhD positive	153 (36.4 %)	681 (35.7 %)			
A RhD negative	2 (0.5 %)	131 (6.9 %)			
B	13 (3.1 %)	185 (9.7 %)		155,578 (11.8 %) 20,462 (1.5 %)	8 % 2 %
B RhD positive	13 (3.1 %)	165 (8.7 %)			
B RhD negative	0 (0 %)	20 (1.0 %)			
AB	1 (0.2 %)	73 (3.8 %)		48,848 (3.7 %) 7225 (0.5 %)	2 % 1 %
AB RhD positive	1 (0.2 %)	59 (3.1 %)			
AB RhD negative	0 (0 %)	14 (0.7 %)			
RhD	416 (99.0 %)	1598 (83.8 %)	< 0.001		
RhD positive	4 (1.0 %)	309 (16.2 %)			
RhD negative					

* Hirani R, Weinert N, Irving DO. The distribution of ABO RhD blood groups in Australia, based on blood donor and blood sample pathology data. Medical Journal of Australia. 2022;216(6):291–5

[a] Australian Red Cross Lifeblood. Blood types. https://www.lifeblood.com.au/blood/learn-about-blood/blood-types

Table 3
Alloantibody specificities by blood group system in Aboriginal and non-Aboriginal patients.

Blood Group System	Alloantibody Specificity	Total (n = 154)	Aboriginal (n = 77)	non-Aboriginal (n = 77)
Rh (RH)	Anti-E	23	6	17
	Anti-e	1	1	0
	Anti-D	10	0	10
	Anti-C	6	2	4
	Anti-c	5	1	4
	Anti-Cw	3	1	2
		48	11 (14.3 %)	37 (48.0 %)
Kell (K)	Anti-K	19	5	14
	Anti-Kpa	4	0	4
		23	5 (6.5 %)	18 (23.4 %)
Duffy (FY)	Anti-Fya	5	0	5
		5	0 (0 %)	5 (6.5 %)
Kidd (JK)	Anti-Jka	7	1	6
	Anti-Jkb	1	0	1
		8	1 (1.3 %)	7 (9.1 %)
MNS (MNS)	Anti-M	16	11	5
	Anti-N	1	0	1
	Anti-S	2	1	1
		19	12 (15.6 %)	7 (9.1 %)
P1 (P1)	Anti-P1	6	5	1
		6	5 (6.5 %)	1 (1.3 %)
Lewis (LE)	Anti-Lea	29	28	1
(45)	Anti-Leb	16	15	1
		45	43 (55.8 %)	2 (2.6 %)
Total		154	77 (50 %)	77 (50 %)
Antibodies		68	59 (76.6 %)	9 (11.7 %)
IgM antibodies		(44.2 %) 86 (55.8 %	18 (23.4 %)	68 (88.3 %)
IgG antibodies				

(IgM) with most frequently identified alloantibodies in our cardiothoracic surgical patients were anti-Lea, anti-E and anti-K, their distribution differed between Aboriginal and non-Aboriginal patients.

There were significant differences between Aboriginal and non-Aboriginal patients with respect to frequency and distribution of IgM and IgG alloantibodies including the antibody specificity. IgM alloantibodies (anti-Lea, anti-Leb, and anti-M) were found most frequently in Aboriginal patients whereas IgG alloantibodies (anti-E, anti-D, and anti-K) were more frequent in non-Aboriginal patients. In addition, half of the antibodies at the time of cardiac surgery in our study were IgM.

IgG blood group alloantibodies (Rh, K, Fy, Jk) react optimally at 37 °C and are usually RBC immune mediated and are clinically important for transfusion requiring antiglobulin crossmatch compatible antigen negative RBCs for transfusion. IgM blood group alloantibodies (Le, P1 and parts of the MNS system) are usually naturally occurring (non-red cell immune) and in most cases are non-reactive at 37 °C, with a lower thermal amplitude, and are rarely clinically significant. Previous studies have identified a preponderance of IgM alloantibodies such as Lea and Leb in Southeast Asians and anti-M in Chinese individuals [13]. The reason for the high preponderance of IgM alloantibodies in the Aboriginal Australian and Southeast Asian population-based studies is uncertain.

In general transfusion practice, the presence of IgM alloantibodies typically does not necessitate providing antigen-negative red cells (RBCs) for transfusion. Instead, RBCs crossmatch compatible by antiglobulin crossmatch at 37 °C are considered safe and acceptable for transfusion, with no observed clinical sequelae. However, in the setting of cardiac surgery, an induced hypothermic state is often used. In this context, and when circulating IgM alloantibodies are present, they may theoretically have greater clinical significance, due to their lower thermal amplitude, and the low body temperature of cardiopulmonary bypass. It is possible that in such cases, either antigen-negative RBCs, or RBCs crossmatch compatible at 32 °C may be necessary, to minimize any risk of haemolytic transfusion reactions intraoperatively. The uncertainty lies in whether the presence of these IgM alloantibodies and hypothermia leads to microvascular agglutination and associated complications, and our data are unable to answer these unknowns. The Cleveland Clinic reported an occurrence of 0.2 % of cold antibodies detected before or within 30 days of surgery in 47,373 patients undergoing cardiovascular surgery. Of the 99 patients identified, 97 underwent hypothermic surgery and 4.1 % of those patients did have intraoperative agglutination [14]. The rate of alloantibodies that we have reported is significantly higher for both Aboriginal and non-Aboriginal patients, when compared to this report, suggesting the opportunity for exposure to risk may be greater.

Some existing strategies do aim to mitigate the risks of alloantibodies in the hypothermic context of cardiac surgery. Watanabe et al. [15] adopted a multidisciplinary patient blood management strategy for a patient undergoing cardiac surgery at 30 °C with blood type A RhD(+) Ok(a−), and anti-Ok[a], an extremely rare antibody against red cell antigen. Their strategy included preoperative patient optimization of Hb and ensuring the availability of Ok(a-) RBC, intraoperative strategies including acute normovolemic hemodilution, restricting pre-bypass intraoperative fluid administration, and using tranexamic acid to suppress hyperfibrinolysis. For most cardiac surgeries hypothermia can be avoided if necessary, however in those requiring circulatory arrest, such as some aortic surgeries, with cooling to 20 °C or below, the potential risk of haemolysis is increased. Current surgical practice at our

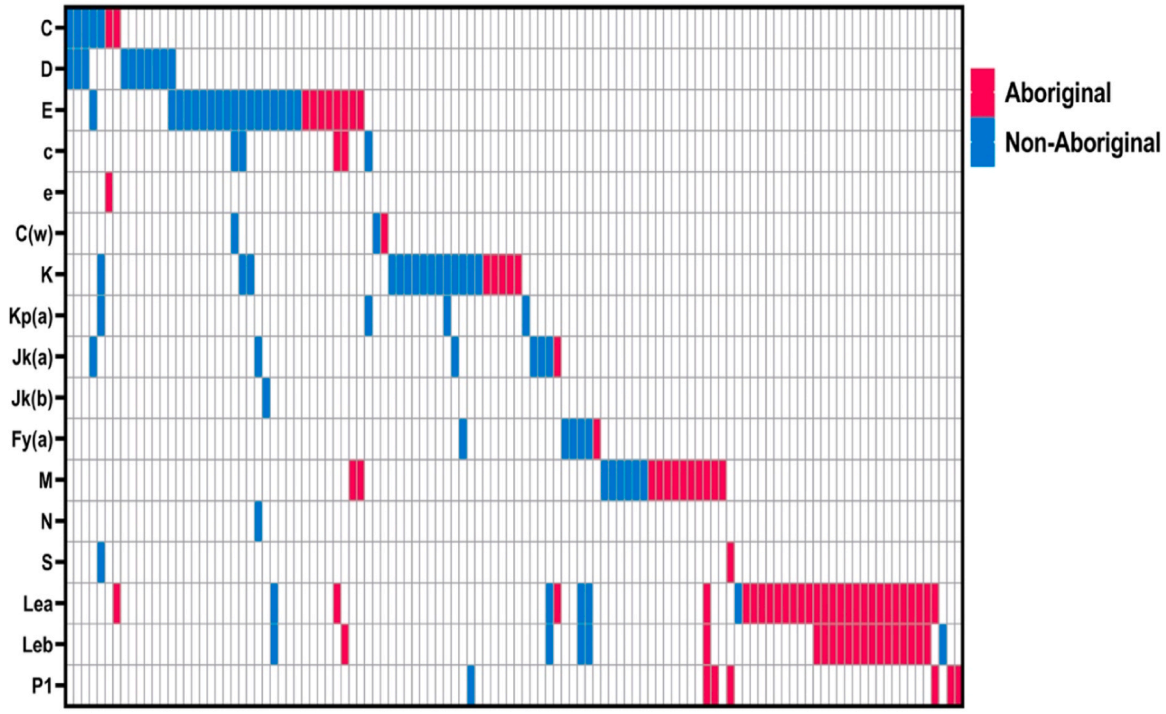

Fig. 2. Heat map of antibody specificities for Aboriginal and Non-Aboriginal cardiac surgery patients.

Table 4
Alloantibody specificities detected and not detected at the time of surgery.

Blood Group System	Antibody Specificity	Total (n = 154)	At the time of surgery (n = 84)	After surgery (n = 52)	Pre-existing not detected at surgery (n = 18)
Rh (RH)	Anti-E	23	14	7	2
	Anti-e	1	0	1	0
	Anti-D	10	4	6	0
	Anti-C	6	2	4	0
	Anti-c	5	4	0	1
	Anti-Cw	3	1	2	0
Kell (K)	Anti-K	19	5	10	4
	Anti-Kpa	4	3	1	0
Duffy (FY)	Anti-Fya	5	4	1	0
Kidd (JK)	Anti-Jka	7	4	2	1
	Anti-Jkb	1	1	0	0
MNS (MNS)	Anti-M	16	9	6	1
	Anti-N	1	1	0	0
	Anti-S	2	0	2	0
P1 (P1)	Anti-P1	6	2	2	2
Lewis (LE)	Anti-Lea	29	20	5	4
	Anti-Leb	16	10	3	3

institution requires minimal patient cooling and the avoidance of hypothermia (<32 °C) for most procedures.

Currently, pretransfusion testing guidelines [16] do not require specific testing at temperatures < 37 °C for cardiac surgery patients undergoing hypothermic surgery, rather it is recommended to provide crossmatch compatible RBCs not active at 37 °C if IgM type alloantibodies are present. However based on our findings the current guidelines may need to be revised for cardiovascular patients with IgM alloantibodies, particularly those active at 37 °C to provide antigen negative RBCs to minimise the risk of antibody associated haemolysis [14] or in vivo RBC agglutination at less than normal body temperature.

While following up on the alloantibody status of patients from the NT, we found that several preexisting antibodies detected historically in the NT, were not detected at the time of admission for surgery in SA. Variable rates of antibody evanescence have been reported previously that differ based on patient population, antibody techniques' sensitivity, and follow-up time [17]. Having an accurate RBC alloantibody history and documentation for patients is important in preventing future delayed haemolytic transfusion reactions. With cross border flow of patients between different states in Australia for clinical care and the current lack of shared information systems on transfusion and RBC alloantibody history across borders between Australian states and territories, our findings highlight the importance of the development of a national antibody register.

Our findings also confirmed Aboriginal patients had a significantly higher prevalence of blood group O and RhD Positive blood groups compared to non-Aboriginal patients. Our results on blood group and Rh status are comparable with the study by McLean et al. [8] where 56.6 % of Aboriginal patients were group O and 97.6 % were RhD positive. Although the prevalence of group A (39.7 %) in Aboriginal patients was comparable with our study, the prevalence of group A in non-Aboriginal patients in our study was higher, 42.6 % vs 37.1 % compared to the McLean et al. study [8]. Our study cohort of specific cardiac surgery patients had a higher proportion (64.3 %) of Aboriginal patients from

NT compared to 56.6 % in the McLean et al. study [8]. The distribution of RhD negative blood group in non-Aboriginal patients in our study was comparable with the findings from the recent study of 15.2 % from SA patient samples [7]. Importantly our O RhD negative data confirms the decrease in frequency of O RhD negative in the population compared to first time blood donor data from 1993–94 [18]. Studies on the distribution of ABO RhD blood groups similar to ours by McLean et al. [8] and Hirani et al. [7] support the Australian Health providers in planning their inventory stocks of blood and blood products and risk management.

In conclusion, we found a high prevalence of RBC alloantibodies, particularly IgM class in Aboriginal patients undergoing cardiac surgery. Such antibodies in cardiac surgery patients, currently are often thought of as not necessarily clinically significant when in fact they may cause unrecognized clinical sequelae, requiring further pretransfusion investigations and the provision of antigen negative RBCs, and may cause delays in finding crossmatch compatible blood. Our subset of NT patients with previously identified clinically significant alloantibodies that were not present at time of surgery in SA support the need for a national antibody transfusion registry. Further studies are needed to confirm the significance of the high incidence of IgM antibodies in Aboriginal individuals and the local clinical relevance of them particularly in hypothermic cardiac surgery.

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CRediT authorship contribution statement

David Roxby: Conceptualization, Formal analysis, Funding acquisition, Methodology, Project administration, Writing – review & editing. **Maree Perry:** Formal analysis, Writing – review & editing. **Tina Noutsos:** Conceptualization, Data curation, Formal analysis, Methodology, Resources, Writing – review & editing. **Robert Baker:** Conceptualization, Data curation, Formal analysis, Resources, Writing – review & editing. **Romi Sinha:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft.

Conflict of interest

There is no conflict of interest.

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