Original Investigation

Placental Pathology Reporting Practices in Australian Stillbirths: A Quality Review

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Abstract

Background: Stillbirth continues to pose a significant public health challenge. Autopsy and placental assessments are recognized as the gold standard for stillbirth investigation. The utility of these procedures can vary based on the quality of the examination. The aim of this study is to determine the quality of placenta pathology reporting in Australia in the context of a stillbirth.

Materials and Methods: Placenta pathology reports from stillbirths were reviewed from 18 maternity hospital from 2013 to 2018. The Khong tool was used to produce a placenta quality score (PQS), by a blinded panel of assessors to the cause of death. Outcome measures were the number of reports achieving the minimal acceptable score (MAS) of 75% or a poor score (PS) of 50% of the PQS.

Results: 560 placental pathology reports of which 494 were singleton and 66 were twin placentas. 282 (50%) achieved the MAS score. Macroscopic items were recorded well and microscopic items recorded poorly.

Conclusions: The standard of placenta pathology reporting can be improved in Australia. The use of templates or checklists for both macroscopic descriptions and histological reporting is recommended to ensure all key components are described.

Keywords
stillbirth, placenta, quality, pathology, structured reporting

Introduction

Australia is one of the safest places in the world for pregnancy and childbirth, yet the national rate of stillbirth (defined as the birth of a baby without signs of life, at 20 or more completed weeks of gestation or at a weight of 400 grams or more) remains higher than other high-income countries and continues to affect more than 2000 families each year.[1-4] In Australia, 17% of stillbirths are classified as unexplained, with up to 36% unexplained at term.[5]

Multiple studies have shown placental examination by a pathologist, is the most useful investigation in determining the cause of death of a stillbirth,[6-8] yet studies related to quality of these placental pathology reports are very limited.[9] Khong and Gordijn in 2003 examined 181 reports and found 48 (33%) reports failed to achieve a minimal acceptable score (MAS) where MAS was defined as 75% of the maximal achievable absolute score.[9]

A thorough examination of the placental can be of significant clinical utility. The placenta can develop lesions, affecting its function, leading to morbidity for both the mother and baby; and mortality for the baby.[6] It can be used to inform clinical management for both the mother and baby in the post-partum period[7] and often inform care in the subsequent pregnancies.[8] In Australia in 2021, the most common cause of death in stillbirths was congenital anomaly, unexplained antepartum fetal death, maternal conditions, and placental dysfunction.[10] The placental report is an important component used in the classification of stillbirth, with Perinatal

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Society of Australia and New Zealand, Clinical Practice Guideline for perinatal death classification (PSANZ-PDC) having a separate category for placental dysfunction or causative placental pathology.[11]

The quality of the placental pathology report is important as more clinically relevant information is likely to emerge from a high-quality investigation.[12,13]

One measure of the quality is assessing the amount of relevant information in the report. A limitation of this approach is that it does not give any indication of skill/experience of the medical specialist who performed the examination, if the findings were correctly interpreted and if all available potential pathologies were investigated.[14]

The purpose of this study is to determine the quality of placental pathology reports for stillbirths in Australia.

Materials and Methods

Study Sample

This study forms part of the Stillbirth Causes study, which was a large multi-center, prospective cohort study across maternity services in Australia to identify an optimal investigation protocol for stillbirths and has been described previously in detail.[15] Stillbirths at ≥20 weeks' gestation and/or ≥400 grams birthweight were eligible for inclusion. Terminations were excluded. Over the period from 2013 to 2018, 18 maternity hospitals submitted 697 pathology reports from stillbirths for inclusion in the study. Placental pathology was performed in specialist perinatal pathology and general anatomical pathology departments. Cases were excluded if the pathology reports were not submitted as part of the main study data set. 573 stillbirths with pathology reports were included in this study; of these 560 cases had a placental pathology report and were available for inclusion in this study.

Development of the Tool

A Khong placental quality tool was used to assess the reports (Table 1) as previously described by Khong and Gordijn.[16] The Khong tool produces an absolute score which we have termed placental quality score (PQS = 76 points for singleton; 166 points for twin). A pilot study of randomly selected 29 cases (5% of study population) was conducted to determine if the Khong tool is suitable for use and was found to be fit for purpose. A minimal acceptable score (MAS) was 75% of the maximum achievable PQS (57 points for singleton; 125 points for twins). A poor score (PS) was 50% or less of the maximum achievable PQS (38 points for singleton; 83 points for twins).

Case Review Procedure

Case review assessors were identified by seeking an expression of interest through the investigators of the Stillbirth Causes study. Five assessors with Pathology training formed the panel. The assessors undertook initial training on the use of the Khong tool in individual meetings with the lead investigator (TM).

Each stillbirth report was assessed independently by 2 assessors, blinded to the cause of death (assessor groups). Cases were randomly allocated to the assessors by the lead investigator. Deidentified pathology reports (pdf format) were extracted from the main study data set and provided to the assessors via a secure folder using University of Queensland Research Data Manager (UQRDM). If there was discrepancy between the assessors, the case was reviewed by the lead investigator.

Data Collection and Analysis

For the overarching cohort study, participating hospitals were asked to investigate, review, and classify the cause of death for all stillbirths according to the PSANZ PM CPG[17] and enter study data into a purpose-built application.[9] Data included demographic characteristics, pregnancy outcomes, investigations undertaken, and cause of stillbirth.

Following review by the assessors, data for the quality study were entered into a purpose-built database to score the information in the reports. Descriptive statistics of the quality outcomes was performed.

Outcome Measures

The main outcome measure was the number (%) of placental pathology reports achieving MAS of 75% and PS of 50%. Subgroup analysis was performed for the type of placenta (singleton or twin) and the type of laboratory performing the examination (specialist or general).

Ethics Approval

Approval was granted from Institutional review boards in each state or territory.

Results

560 placental pathology reports of which 494 were singleton and 66 were twin placentae. 282 (50%) achieved the MAS score (green line) and 278 (50%). Of those, 131 (23%) reports achieved a score of 91% or more of the PQS. Of those not achieving the MAS (282), 62 cases (11%) were in the PS group (orange line) (Table 2).

522 (93%) were reported from a specialist pathology laboratory while 38 (7%) were from a general pathology laboratory. Of the placenta reported by a general laboratory, 14 reports achieved the MAS or more, with 7 reports scoring 91% or more of the PQS. 10 reports were in the PS group (3 twin), which contributed to 20% of the overall cases in the PS group.

Table 1. Khong Placenta Quality Assessment Tool.

Factor category	Factor breakdown	Score
Clinical summary/history of pregnancy	Current pregnancy, date of term, illness during pregnancy, delivery details.	10
Placenta: gross and histology	Singleton	66
	Gross	
	Umbilical cord	
	Length	1
	Diameter	1
	Insertion site	1
	Number of vessels	1
	Coiling index	1
	Membranes	
	Completeness	1
	Rupture site	1
	Disc	
	Untrimmed or trimmed weight	1
	Trimmed and untrimmed weight	2
	Fresh or fixed weight	1
	Dimensions	
	Length × width × height	3
	Length × width	2
	Width	1
	Description of gross abnormalities of cord,	8
	membranes,	8
	disc or specific mention of no abnormalities	8
	Histology	
	Description of gross abnormalities of cord,	8
	membranes,	8
	disc or specific mention of no abnormalities	8
	Final diagnosis	5
	Deduction of points (if placenta disc only reported)	
	• No commentary where there were abnormal findings	1
	• No commentary correlating the placental examination with the clinical history	1
	• No commentary of recurrence risk if a diagnosis was made of villitis, massive chronic intervillositis, retroplacental haemorrhage, placenta accreta, fetal or maternal vascular malperfusion, maternal floor infarction, or massive perivillous fibrin deposition	1
	Multiple pregnancy (as above for each pregnancy)	
	Description of degree of fusion of the discs	8
	Type of chorionicity	8
	Birth order	8
	Twin	156
	Triplet	222

Twin Reports

Of the twin reports, 14 (21%) achieved the MAS and 52 (79%) did not achieve the MAS. Of those achieving the MAS, 2 (3%) reports achieved a score of 91% or more of the PQS. Of those not achieving the MAS 31 (47%) were in the PS group.

The PQS ranged from 19 to 160, with a mean of 90 and a median of 88.

Twin reports scored poorly when birth order (44%), degree of disc fusion (36%) and chorionicity (17%) were not recorded (Table 3).

41 twin placentae (62%) were from extremely premature stillbirths (20.0–28.6 weeks gestation), with 11 of these achieving MAS and 16 were in the PS group (Table 4). Extremely premature placentas accounted for 52% of the PS group for twins. Two placentae (3%) were term stillbirths with one of these in the PS group.

Singleton Reports

For the singleton placentae, 268 (54%) achieved the MAS and 226 (46%) did not achieve the MAS. Of those achieving the MAS, 129 (26%) reports achieved a score of 91% or

Table 2. Placental Quality Scores.

TOTAL (n = 560)		Singleton (n = 494)	Twin (n = 66)
PQS %	n (%)	n (%)	n (%)
100	77 (14)	76 (15)	1 (1.5)
91–95	54 (10)	53 (11)	1 (1.5)
76-90	131 (23)	119 (24)	12 (18)
75 (MAS)	20 (4)	20 (4)	0 (0)
51–74	216 (39)	195 (39)	21 (32)
50 or less (PS)	62 (11)	31 (6)	31 (47)

Table 3. Khong Placenta Assessment Tool Scores.

Khong tool	n = 560 (%)
A. Clinical summary/history of pregnancy: current pregnancy, date of term, illness during pregnancy, delivery details.	463 (83)
G. Placenta gross: umbilical cord—length	542 (97)
G. Placenta gross: diameter	498 (89)
G. Placenta gross: insertion site	491 (88)
G. Placenta gross: number of vessels	406 (73)
G. Placenta gross: coiling index	311 (56)
G. Placenta gross: membranes—completeness	333 (59)
G. Placenta gross: description of membranes	485 (87)
G. Placenta gross: rupture	123 (22)
G. Placenta gross: disc—untrimmed or trimmed	330 (59)
G. Placenta gross: trimmed and untrimmed	271 (48)
G. Placenta gross: Fresh or fixed	94 (17)
G. Placenta gross: dimensions—length × width × height	317 (57)
G. Placenta gross: dimensions—length × width	201 (36)
G. Placenta gross: dimensions—width	252 (45)
G. Placenta gross: description of gross abnormalities of cord	444 (79)
G. Placenta gross: description of disc or specific mention of no abnormalities	407 (73)
Placenta histology: description of abnormalities of cord, membranes, disc, or specific mention of no abnormalities.	411 (73)
Placenta histology: description of membranes	406 (73)
Placenta histology: description of disc or specific mention of no abnormalities.	163 (29)
Placenta histology: final diagnosis	275 (49)
Placenta histology: no commentary where there were abnormal findings	76 (14)
Placenta histology: no commentary correlating the placental examination with the clinical history	62 (11)
Placenta histology: no commentary of recurrence risk if a diagnosis of villitis, massive chronic intervillositis, abruptio placentae, placenta accreta, fetal or maternal thrombotic vasculopathy, maternal floor infarction or massive perivillous fibrin deposition was made.	31 (6)
Placenta histology: multiple—degree of fusion of discs	24 (36)
Placenta histology: multiple—type of chorionicity	11 (17)
Placenta histology: multiple—birth order	29 (44)
Placenta histology: TWIN	66
Placenta histology: TRIPLET or greater chorionicity	0

more of the PQS. Of those not achieving the MAS, 31 (6%) reports were in the PS group. The scores ranged from 16 to 76, with a mean of 57 and a median of 57. 251 placentae (51%) were from extremely premature stillbirths (20.0–28.6 weeks gestation). Of these 113 (45%) reported reaching MAS but 22 (9%) were in the PS group (Table 4). 99 (20%) of these were term placentas, of which 58% achieved MAS.

Macroscopic items recorded well included umbilical cord length (97%), umbilical cord diameter (89%), umbilical cord insertion site (88%), and description of membranes (87%). Clinical summary/history of the pregnancy was recorded in 83% of reports.

Items recorded poorly in reports include macroscopic membrane rupture point (22%) and if the placenta was

Table 4. Gestation by Placenta Type.

	Singleton (n = 494)			Twin (n = 66)		
Gestation (wk)	n (%)	MAS (57)	PS (38)	n (%)	MAS (125)	PS (83)
20.0–23.6	153 (31)	86	17	24 (36)	16	7
24.0–27.6	98 (20)	52	5	17 (26)	14	9
28.0–31.6	50 (10)	23	2	13 (20)	6	3
32.0–36.6	94 (19)	43	5	10 (15)	2	6
37+	99 (20)	42	2	2 (3)	0	1

received in a fixed or fresh state (17%). Histology description of disc or mention of no abnormalities (29%) and histology commentary relating to abnormal findings (17%), correlating with clinical history (11%) and recurrence risk of placental pathology (6%) were all recorded poorly.

It was noted that the trimmed weight was recorded but was often not correlated to percentiles for gestational age.

Discussion

This large multicenter study showed that the quality of placental pathology reports in Australian stillbirths is average at best, with only 50% of reports achieving the MAS. This is the largest study examining the quality of placenta pathology with one previous study by Khong and Gordijn.[16] They examined 181 reports and found 48 (33%) reports failed to achieve MAS where, as in the present study MAS was defined as 75% of the maximal achievable absolute score.[9] In the study of Khong and Gordijn components recorded well included the number of cord vessels, cord diameter and length, dimensions of the disc and either a trimmed or untrimmed weight. Components recorded poorly included the site of membrane rupture, completeness of the membranes, and completeness of the maternal disc. For twin pregnancies, the birth order and zygosity was inconsistently reported. Commentaries on gross or histologic abnormalities, and in relation to clinical indications, were inconsistently reported. Our findings are consistent with this earlier study. We found items recorded well included umbilical cord length, umbilical cord diameter, umbilical cord insertion site, description of membranes, and clinical summary/history of the pregnancy. Items recorded poorly include macroscopic membrane rupture point and if the placenta was received in a fixed or fresh state. Histology description of the disc or mention of no abnormalities and histology commentary relating to abnormal findings, correlating with clinical history and recurrence risk of placental pathology were all recorded poorly. In our study, we found 50% did not achieve the MAS, compared to 33% reported by Khong and Gordijn, where placentas scored better for gross examination than microscopic analysis.[16] Our study showed an improvement in the macroscopic description compared to the study of Khong and Gordijn in 2003 and is probably a reflection of multiple factors including 93% of the placentas being reported in specialist perinatal pathology centers where there has been adoption of the 1997 College of American Pathologists[18] and other published guidelines for placental pathological examination.[19-25] From 2014 the Royal College of Pathologists of Australasia also introduced a readily available online cut up manual, that includes videos, for the macroscopic assessment of the placenta.[26]

Although placental pathology can be of significant clinical utility, it can be confusing as many lesions can also be present in other clinical obstetric disorders and be found in healthy live born babies, for example, true knot in the umbilical cord.[23] It is thus important that a commentary correlating the placental examination with the clinical history, and a commentary about the significance of an abnormal findings be provided. This was done in infrequently in our cohort.

Pathologists use different medical terminology that can be quite different from the clinical terminology. This can lead to confusion and ambiguity of the significance of a report. Ptacek et al[27] found considerable variation in the terminology, number and type of abnormalities identified in a systematic review of placental pathology reported in association with stillbirth. A lack of consistency in terminology within pathology and the medical field has been recognized by the pathology experts in the field. In 2014, 26 practicing perinatal and placental pathologists and obstetricians/perinatologists came together in Amsterdam to begin a discussion on standards for macroscopic and microscopic placental examination, sampling, and reporting.[22] This is now referred to as the Amsterdam protocol/criteria. The Amsterdam protocol/criteria is an agreed upon set of uniform sampling criteria, placental gross descriptors, pathologic terminology, and diagnostic criteria was published in 2016 toward the end of our data collection so its impact on the results is uncertain.[22] There is consistency in the various publications and guidelines for macroscopic examination of the placenta, and the importance of providing a commentary.[19-25] Turowski et al describe the essential features of a placental report. It should include clearly defined diagnoses that are understood by the clinicians, evaluation of the extend and severity of lesions, and an estimation of recurrence risk for future pregnancies.

Our study found the commentary relating to abnormal findings, correlating with clinical history and recurrence risk of placental pathology were all recorded poorly.

The Royal College of Pathologists describe a minimum dataset for placental microscopic examination that involves description of cord, membranes, placenta, and a clinicopathological correlation or comment.[24] We found the layouts of the reports and the amount of information included varied significantly between and within laboratories based on individual pathologist preference. Lack of uniformity of reporting could potentially result in some information been accidently omitted or make it more challenging for the referring clinical team to find or interpret information. Use of formatted and structured pathology reporting has shown to have higher rates of completeness, inclusion of all key components, improve communication, and patient safety.[28,29] Ellis and Srigley describe the quality parameters for pathology reporting include timeliness, accuracy, completeness, consistency, and clarity in communication.[30] The use of a checklist will act as a guide to ensure important information is recorded in the report and can act as a reminder when information is missing.[29] The checklist can be an important aid however it is not a supplement for education and knowledge of placental pathology. This study has focused on placentas associated with stillbirths and 93% were performed by specialist pathologists. For indications other than stillbirth, many placentas are examined every year by general pathologists. Studies have shown a gap in knowledge between general and specialist pathologists in identifying placental lesions.[31,32] Interobserver variability of reporting lesions by general and specialist pathologists has been identified as a priority area for future clinical research.[33] This was not assessed in this study, but increased awareness and education of trainees and pathologists is required, particularly around the microscopic descriptions of placentas, as this may improve the quality of placental reporting.

This is the largest Australian study to examine the quality of placental pathology reports using a multicenter, robust tool that was blinded to cause of death. Our study reviewed what was recorded in the placenta report. Limitations of the study include it was unable to consider the experience or skill of the reporting pathologist and their standard of histological reporting, facilities and ancillary testing available, sampling technique used or if anything was missed at the time of assessment.

Conclusion

There is room for improvement in placenta pathology reporting in Australia. The use of templates or checklists for histological reporting, as has been implemented for macroscopic descriptions of surgical specimens, should be considered to ensure all key components are described, and that correlation with clinical history and recurrence risk are included in the report.

Acknowledgments

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Contribution to Authorship

TM conceived and designed the study with VF, TYK, and JED. TM with support from MC, led the development of the tool, the data collection, management, and analysis with support from VF, JED, TYK, JS. YPW, SP, GP, JPK, and TM reviewed the cases.
TM drafted manuscript. All authors reviewed and commented on manuscript drafts and approved the final version for submission.

Data Availability

Study data can be made available upon request.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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Details of Ethics Approval

This study was approved by the Mater Health Services Human Research Ethics Committee on 20 December 2011 (Reference No.: HREC/1745M), Queensland Health/Royal Brisbane & Women's Hospital on 17 December 2012 (Reference No.: HREC/12/QRBW/284), ACT Health HREC on 5 November 2012 (Reference No.: ETH.10.12.220), Northern Sydney Local Health District HREC on 31 January 2013 (Ref No. 1212-411M), HREC of Northern Territory Department of Health and Menzies School of Health Research (Reference No.: HOMER-2012-1876), Aboriginal Health Research Ethics Committee (AHREC) of South Australia on 5 November 2012 (Reference No.: 04-12-480), Women's & Children's Hospital Network (WCHN) HREC on 5 December 2012 (Reference No.: HREC/12/WCHN/69), University of Tasmania HREC Tasmania Network on 30 November 2012 (Reference No.: H0012864), Mercy Health HREC (Victoria) on 11 June 2013 (Reference No.: R13/07), and Western Australia Aboriginal Health Ethics Committee on 19 November 2012 (Reference No.: 447). Due to delays and complications during the HREC review process, no stillbirths were recruited from health facilities in Western Australia.

Consent to Participate

All parents of study participants provided consent at the hospital level for any investigations completed. Due to the level of data sensitivity (non-identifiable), a waiver of consent was requested and approved to collect and analyze data for the purpose of this study.

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