Orthopaedic Surgeon, Dr B

West Coast District Health Board

A Report by the

Health and Disability Commissioner

(Case 06HDC09552)

Health and Disability Commissioner
Te Toihau Hauora, Hauātanga

Parties involved

Mrs A	Consumer
Dr B	Provider/Orthopaedic surgeon
Dr C	Orthopaedic surgeon
Dr D	Radiologist
Dr E	Vascular surgeon, Hospital 2
Dr F	Locum orthopaedic surgeon
West Coast District Health Board	Provider
Hospital 2	A large public hospital

Complaint

On 28 June 2006, the Commissioner received a complaint from Mrs A about the services provided by orthopaedic surgeon Dr B and West Coast District Health Board (WCDHB). The following issues were identified for investigation:

- *The appropriateness of Dr B's preoperative planning, surgery and postoperative care of Mrs A's knee joint replacement surgery.*
- *The appropriateness of the orthopaedic perioperative care provided by West Coast DHB to Mrs A.*

In the first instance information was gathered and preliminary expert advice obtained. Based on this report an investigation was commenced on 12 February 2007. Completion of the investigation has been delayed while awaiting a response from Dr B.

Information reviewed

- Information from Mrs A
- Information from Dr B (including a report from Dr Dawe)
- Information from Dr C
- Relevant policies from WCDHB
- Letter from Dr D
- Mrs A's medical records from WCDHB and Hospital 2

Independent expert advice was obtained from orthopaedic surgeon Dr Garnet Tregonning.

Information gathered during investigation

Overview
On 7 November 2005, Mrs A had a right total knee joint replacement performed at Grey Hospital by orthopaedic surgeon Dr B. Following the surgery Mrs A was noted to have limited circulation to her lower right leg.

On 10 November 2005, Mrs A was flown to a large public hospital (Hospital 2) for an assessment by vascular surgeon Dr E as Mrs A's circulation to her lower limb was compromised. However, her circulation could not be restored and she had an above knee amputation of her right leg on 12 November 2005.

Dr B
Dr B was recently qualified in orthopaedic surgery at the time of these events. He obtained vocational registration in orthopaedic surgery in May 2005. He advised:

> "I am a member of the Royal Australasian College of Surgeons and the New Zealand Orthopaedic Association. I underwent advanced training in Orthopaedics between 2001 and 2004. During this period I assisted in well over 100 knee replacements and performed knee replacements with a Consultant Surgeon assisting me. At the time of [Mrs A's] surgery I would have performed fewer than 10 knee replacements as a Consultant Surgeon. Subsequently I have undergone an arthroplasty fellowship [overseas] and on my return to New Zealand have performed more than 30 knee replacements as a Consultant Surgeon."

Dr B was employed as a locum orthopaedic consultant by WCDHB and completed two short-term contracts during 2005: January to May 2005 and November and December 2005. He advised that on his arrival in Greymouth in January 2005 he was provided with information about the hospital and was shown around the theatre block and wards. Dr B stated that he also met with Dr C, senior orthopaedic surgeon at Grey Hospital, to discuss the running of the orthopaedic service. Dr B said that at the time of Mrs A's surgery he was familiar with the running of the orthopaedic theatre, postoperative recovery room and the ward.

Chronology

Preoperative assessment
Mrs A, aged 47, suffered with osteoarthritis of both knees. On 22 March 2005, she was assessed at the orthopaedic clinic in a nearby town, by locum orthopaedic surgeon, Dr F. He recorded the following:

> "On examination, [Mrs A] is overweight [134 kg] and walks with a lurching gait and has neutral knee alignment bilaterally with some appearance of being knock-kneed, but I think this is just because of the large thighs, meaning she has to get her feet apart and I think the actual alignment of her knees is

> probably neutral. She has a range of motion from 0 - 80° flexion on both sides limited by fat rolls. She is predominantly medial compartment joint line tenderness on both knees with no hip irritation. Good pedal pulses. Ligaments stable.
>
> X-rays show medial compartment joint space loss which is moderately severe.
>
> She is only 47 years of age and I think would benefit from pursuing as much conservative management as possible. Surgical options would be a [HTO],[1] uni or total knee replacement. I worry a little about doing valgusing osteotomies because of the large thighs she has. This will make her stance even wider. I think the option would probably be uni compartmental knee replacement but I would like to avoid this as long as possible as they would have a limited life expectancy given her age and her weight.
>
> We talked about conservative management and she is going to talk to her doctor about possibly increasing her anti-inflammatory dose. When she gets to the stage where she is having difficulty controlling her pain with painkillers then she could be referred for further consideration. As there is a relative lack of mechanical symptoms, I don't think an arthroscopy and debridement are likely to give her significant improvement at this stage."

However, when Mrs A was reviewed by Dr F again on 14 April 2005 her condition had deteriorated. Dr F reported:

> "[Mrs A] saw me at the end of my clinic today. She is getting a lot worse with regard to her knees and is walking with two crutches. She hasn't had a chance to increase her medications yet but looking at the way she is doing today I am not sure that we are going to succeed with conservative management. I don't have all her notes or X-rays today so I can't remember the full story. She needs to come back to clinic to see an orthopaedic surgeon to re-assess whether or not she is a candidate for knee arthroplasty or at least debridement.
>
> Hopefully we can get her in the next couple of weeks to discuss this again."

On 28 April 2005, Mrs A consulted Dr B for the first time. Dr B stated:

> "This woman has previously been seen by [Dr F] regarding bilateral medial compartment OA of her knees. I understand he saw her two weeks ago but unfortunately I do not yet have a copy of his clinical notes.

[1] High Tibial Osteotomy.

> At this time she tells me he recommended that she be brought forward for knee replacement surgery.
>
> On consultation today, [Mrs A] tells me she has both rest and activity related pain. We have discussed the potential complications of total knee joint replacement surgery. She understands these and wishes to come forward on the waiting list. I have also explained to her that it will be several months before she will be done."

Dr B advised that he discussed the risks of surgery with Mrs A and explained that she might need to have the replacement re-done again later because she was so young. He stated that he routinely tells patients about the associated pain, that it will take several months to recover, the chance of infection (in about one percent of cases) and that occasionally the prosthesis will have to be removed to control the infection. Dr B said that he also warns patients that there is a risk of blood clots in less than one percent of cases, which can be life-threatening if one becomes dislodged and travels to the lungs, and that they will require blood-thinning medication to reduce this risk. He also gives patients requiring joint replacement surgery a pamphlet about the surgery. A copy of this booklet was provided by WCDHB. It does not include information about the risks of the surgery.

Dr B explained that he tells patients about the most serious complications associated with a knee replacement procedure to make them aware that this is major surgery. At the time of Mrs A's surgery he did not routinely discuss the risk of amputation although he did mention the possibility of damage to nerves and blood vessels. Dr B said that vascular injury is a recognised but rare complication, which he estimates would occur in well under 0.1 percent of cases. He referred to an American study where the incidence of above knee amputation for causes related to a knee replacement was 0.14 percent, with only one instance of an amputation being due to arterial injury (the majority being caused by infections).

Dr B stated that he did recognise that due to Mrs A's size it would not be a routine knee replacement procedure. (Mrs A weighed 134 kg and at 1.52m tall had a BMI of 57). Mrs A recalls that Dr B went over the risks of the operation but did not mention amputation. She said that she specifically asked Dr B whether there were any particular risks due to her weight and was told that it would not be an issue. She recalls being surprised that he was prepared to replace her knee joint because other specialists had told her they would not do it because of her size. Mrs A said that she anticipated Dr B would tell her the same thing. Instead he agreed to the surgery but told her that it would be delayed until he returned from overseas.

Dr B said that he completed the necessary waiting list application (signed by Dr C), predicting a delay of five months.

On 19 September 2005 Mrs A saw another orthopaedic surgeon. He recorded that she felt that her pain was somewhat better than six months ago and that she was coping with one walking stick only. He injected each of Mrs A's knees with Kenacort[2] and some local anaesthetic. He advised her GP that in view of her young age they should try every conservative measure prior to embarking on surgery and that she should be reviewed in six to eight weeks' time.

Mrs A completed an orthopaedic surgery self-assessment form on 5 October 2005 describing herself as unable to walk, being dependent on others and having a pain level of ten out of ten. On 18 October 2005 Dr C reviewed Mrs A's place on the waiting list. He noted a significant clinical deterioration and recommended that her status be upgraded to urgent.

Knee replacement surgery

On 6 November 2005, Mrs A was admitted to Grey Hospital for total knee replacement surgery, planned for the following day. Before surgery Dr B saw Mrs A, marked the leg to be operated on and confirmed that she wished to proceed with the operation. Dr B discussed his surgical requirements with the theatre manager, arranged for an extra nurse to be in attendance and booked extra theatre time.

As arranged, Dr B performed Mrs A's surgery on 7 November 2005, assisted by a general surgeon. The anaesthetic was commenced at 9.05am, the surgery was completed at 1.52pm, and Mrs A arrived in the post-anaesthetic care unit (PACU) at 2.16pm. Dr B recorded that patella eversion was difficult due to the abundance of soft tissues.[3] When the components were trialled Mrs A had significant hyperextension of the knee. A larger rotating platform component was then inserted which resulted in a good range of knee movement with no hyperextension. A full record of the operation note is set out in Appendix 1.

After surgery Dr B reviewed Mrs A in PACU. He described her right foot as "well perfused" (good circulation). Although he found it difficult to feel her foot pulses anteriorally,[4] "the posterior tibial pulse could be located easily on doppler", [5] and she was able to move her right foot well.

At 4.15pm, Mrs A returned to the ward. Her pain was controlled with epidural anaesthesia and her observations were stable. She was unable to use TED (ante embolic) stockings as her legs were too large. The circulation to her right foot was

[2] A synthetic glucocorticoid corticosteroid with an anti-inflammatory action.

[3] The patella is the flat movable bone at the front of the knee.

[4] Anatomically there are two main pulse points on the foot; one that runs across the instep at the front (anterior) of the foot and the other that can be felt at the back below the ankle (posterior tibial).

[5] An electronic device that records an audible pulsation as blood travels down an artery.

observed hourly. Her foot was warm and pink with good arterial return, but the pulses in her foot were barely palpable. The epidural anaesthesia made it difficult to assess sensation. In the early morning, her circulation was noted to be improving, her foot was warm and pink, and pulses could be felt.

At 8.45am on 8 November 2005, Dr B reviewed Mrs A. She complained of pain behind her knee and reduced sensation in her leg. Dr B thought the pain might be a small clot related to the bolster pillow supporting her leg, and the reduced sensation secondary to the epidural anaesthesia. At 9am and 2pm, Mrs A had physiotherapy. At 10.50am the nursing staff could not find any pulses, either on palpation or by doppler. At 11.15am, Mrs A was reviewed by the house surgeon, Dr G, who was able to find pulses using the doppler. His assessment was documented by the nursing staff. At this stage, Mrs A's observations were being recorded two-hourly. At times, she had no palpable pulses in her foot but pulses could be heard using the doppler.

At 2pm Dr B and Dr G assessed Mrs A's circulation again. She still had the pain in her calf, her knee was swollen and this had increased since his last assessment. Dr B thought the swelling was due to the surgery. At 9.30pm that night, another house surgeon was asked to review Mrs A because of the pain in her foot. He found that when he pressed her ankle, the pain was severe. At this stage, only the posterior tibial pulse was identifiable using the doppler. He discussed his observations with Dr B by telephone, and it was decided to continue to observe the foot.

On 9 November 2005 at 4.15am, Mrs A was reviewed again by the house surgeon. She had no detectable pulse anteriorally or posteriorally. He recorded:

> "04.15 … ATSP [asked to see patient] as PT [post tibial] pulse was unable to be found — since heard clearly.
> Still c/o pain post R calf
> R toes less warm than L but not cold.
> CRT [circulation return] 3 — 4 S[econds]
> No pain on passive movement of toes/forefoot. Pain on doriflexion
> Remains tended in calf
> P[lan] continue."

Mrs A was very uncomfortable and estimated her calf pain as 10 (on a scale of 10). She was given oral morphine at 4.15am. Dr B assessed Mrs A at 8.30am. He stopped the epidural, and ordered alternative analgesia (Codeine, Morphine and Panadol), blood tests, and calf measurement.

At 11.30am house surgeon Dr G was asked to see Mrs A because her right foot, which had been pink, was now "mottled", white to purple at times, and the posterior pulse was also less audible using the doppler. The epidural anaesthesia had been stopped at 10am, but she still had no sensation or movement of her right foot. Dr G found a faint pulse and decided to review her again after lunch. At 2.30pm, Dr G reviewed Mrs A

and discussed his findings with Dr B, who was at the orthopaedic clinic in another town. Dr B said that he would review Mrs A upon his return to the hospital, and in the meantime ordered an ultrasound. Dr G reported:

> " …
> [discussed with] radiologist who assisted with USS.
> Flow in femoral vein & in calf
> Flow in popliteal artery & arterial in medial calf
> No collections
> St swelling oedema present
> PCA running now
> Has had 10mg IV Morphine is now sleeping comfortably
> Contact with [Dr B] — informed of above
> He will review Pt on return
> Imp: No evidence of DVT or arterial damage."

The ultrasound was reported on by the radiologist Dr D. Dr D's report stated:

> **"US R KNEE**
> CLINICAL:
> Post TKR. Pain in calf ?Arterial compromise.
>
> FINDINGS:
> The examination is very limited. The common femoral vein and superficial femoral vein were visualised down to the lower third of the thigh and compress normally.
>
> No vein could be identified in the popliteal fossa. A vein with normal flow was seen on the medial aspect of the calf. Arterial flow was noted in the popliteal fossa but it was difficult to identify the arterial vessels above and below. An arterial vessel with good flow was also seen in the medial aspect of the calf.
>
> COMMENT:
> Very limited examination. There is no evidence to suggest a DVT and there appears to be satisfactory arterial flow in the popliteal fossa and into the medial aspect of the calf. If there is ongoing concern I would recommend re-imaging."

Dr D explained that the examination was very limited due to the size of Mrs A's leg, which was very large and swollen postoperatively. He advised that Grey Hospital does not provide a specialist vascular ultrasound service, but performs general diagnostic ultrasound, including assessment for deep vein thrombosis.

At 3.50pm, Dr G summarised the day's findings in Mrs A's notes. The USS report prompted house surgeon Dr G to discuss the matter with Dr D. Dr G recorded the following:

> "d/w [discussed with] [Dr D] — unsure of what would be most appropriate imaging with CT difficult because of knee placement.
> USS again may not be useful
> ?Angiogram
> Dr B to r/v on return from [orthopaedic clinic]
> ?? GTN[6] would be useful!
> Call RMO if any concern."

When asked about the limitations of the ultrasound and his discussion with Dr G, Dr D stated:

> "There was no attempt to carry out a formal arterial ultrasound examination. These matters, including the limitations of this examination and the options for further investigations, were then discussed with the referring medical officer.
>
> I recommended that [Mrs A] be transferred urgently to the vascular unit [at Hospital 2] for arterial assessment, as Grey Hospital was unable to offer specific vascular imaging. The possible options [at Hospital 2] that I mentioned included Doppler arterial ultrasound, CT angiography or conventional angiography.

At 4.10pm, the nursing staff recorded that Mrs A's circulation was deteriorating; her foot was "patchy blue/white & cool", she had no sensation or movement in her foot and pulses could no longer be heard using the doppler. Dr B examined Mrs A when he returned and recorded:

> "11/05 Ongoing Concerns
> Difficult and prolonged operation – tourniquet time 2 hrs 20 min.
> Postop [right] foot pale but good pulse on Doppler. Able to actively dorsiflex foot at this time.
>
> Since then there has been ongoing problems with calf pain and intermittent blanching of [Left] foot.
> Epidural removed today. L foot remains numb. Unable to dorsiflex.
> L [left] foot
>
> Discomfort posterior calf.
>
> Uncomfortable with passive ankle dorsiflex? But no discomfort with ankle inv/eversion; plaster flex? Or gt. [great] toe dorsiflexion.
> Numbness and discolouration. Stocking distribution.

[6] Glyceryl trinitrate: medication used to dilate blood vessels and increase blood flow.

> USS today – limited scan but no evidence DVT, good flow popliteal artery and in medial aspect of calf.
> XRay – satisfactory
> Imp – Vascular spasm affecting [Right] foot
> ? 2° [secondary to] torniquet time/pressure of calf on bolster."

In relation to his diagnosis of vascular spasm secondary to the use of a tourniquet during surgery, Dr B advised:

> "I considered that the ultrasound scan, which reported 'satisfactory arterial flow in the popliteal fossa and into the medial aspect of the calf' made arterial injury unlikely. A limited scan would be more likely to give a false negative result (ie unable to find an artery which was present) than a false positive one (reporting the presence of an artery when there was no circulation).
>
> I did discuss the scan with [Dr D] the following day. By this time however, plans had already been made to send [Mrs A] to [Hospital 2] for vascular review."

On the morning of 10 November 2005 (3rd postoperative day) Dr B spoke to a vascular surgeon in Hospital 2, Dr E, and decided that Mrs A should be transferred there for assessment. Dr B advised that he had also discussed Mrs A's case "in passing" with Dr C, but did not ask him to formally review her.

Surgery at Hospital 2
Mrs A was transferred by air ambulance to Hospital 2 on 10 November 2005. Soon after her arrival, she had an angiogram that revealed the arteries behind the right knee running down through the calf and into the front of the leg were blocked. Attempts to remove the blockage were unsuccessful. Dr E advised Mrs A that she had a "critically ischemic [right] lower limb" that he would explore in theatre, but that the risk of requiring amputation was high.

On 11 November 2005, Mrs A was examined by the general surgical registrar. At 12.40pm, Dr E informed Mrs A that she required an amputation. An amputation above the knee was performed on 12 November 2005. Dr E reported that Mrs A had a "compromised blood flow to the lower leg" and a vein graft had proved unsuccessful.

On 21 November 2005, Mrs A was discharged to Grey Hospital for rehabilitation.

Explanation to Mrs A
On 10 March 2006 Mrs A complained to WCDHB saying that she had never received a proper explanation of events or an apology from either Dr B or WCDHB. Her letter was acknowledged by Kevin Hague, Chief Executive, on 15 March 2006. After a further two months the Nurse Manager Perioperative Services wrote to Mrs A and apologised for the distress and anxiety caused to Mrs A and her family and for the

injury that occurred during the surgery. She then went on to answer some of Mrs A's specific questions about the operation and the checks for bleeding that were carried out before closing the wound.

Dr B stated:

> "I am surprised that [Mrs A] feels that I have never explained or apologised. When I was contacted by [Dr E], Vascular Surgeon, and told [Mrs A's] right leg was not viable I rang [Mrs A] and spoke to her on the ward. I asked if she would see me in [Hospital 2] so we could discuss what had happened. Greymouth Hospital arranged for alternative orthopaedic cover on Sunday 13 November 2005 so that I could drive across to [Hospital 2] and apologise to [Mrs A] in person and explain what had happened. I accept that at the time [Mrs A] was not in the best frame of mind to discuss matters, having recently had surgery.
>
> I did, however, see her frequently following her return to Greymouth Hospital. We discussed her knee replacement surgery and I recall apologising to her again at this time. At that time I, along with other staff members, was impressed with her positive attitude."

At the conclusion of this investigation, Dr B provided a written apology to Mrs A.

Independent advice to Commissioner

On 22 January 2007, the following preliminary expert advice was obtained from orthopaedic surgeon Dr Garnet Tregonning:

> "I have read the information provided to me and in particular [Mrs A's] letter and associated letters from:
>
> - West Coast DHB to the Commissioner
> - Commissioner's letter to [Dr B] dated 17th July 2006.
> - [Dr B's] letter in response dated 19th December 2005 and 24th August 2006.
> - [Mrs A's] relevant medical records (orthopaedic surgery) from Grey Hospital.
> - [Mrs A's] relevant medical records (vascular surgery) from [Hospital 2].
>
> In addition I have conducted a literature review of Vascular Complications of Total Knee Arthroplasty Surgery and have referenced these below.

In response to your question No 1 'What standards apply in this case?' I will answer this with reference to the various phases of the care of the patient.

1. *First Consultation*
   This should include a thorough assessment of the patient including a full history, clinical examination and assessment of available investigations including X-rays. There should be a clear documentation of clinical findings and an indication of a discussion of treatment options including other surgical options.

2. *Preoperative Assessment*
   Ideally this should take place close to the time of operation and take into account the individual patient factors such as the patient's build and clinical well-being, as well as looking at the investigations that have been performed. Pre-operative planning would include planning for the implants to be used, the equipment to be used in the surgery and the necessity for assistance by Medical and Nursing staff. This may also involve consultation with other surgeons and it is usual at this time to obtain informed consent with adequate documentation.

3. *Operative Procedure*
   The Surgeon should have appropriate training, knowledge and experience in performing Total Knee Arthroplasty and appreciate the specific problems of the procedure that may be expected in the particular patient.

   The operation note should clearly document the steps of the operation including some reference to positioning, the pressure and time of inflation of the tourniquet, the approach and implants used and the details of closure. It should also include any difficulties or unusual occurrences during surgery.

   There should be clear and adequate postoperative instructions including assessment of neurovascular function.

4. *Postoperative Assessment*
   The patient should be seen in the Recovery Room (PACU) and any particular concerns noted. There should be assessment of the volume of drainage of blood into drainage systems and the neurovascular status of the limb.

   Ideally the patient should be seen by the Surgeon daily for the subsequent 3-4 days and more often by Junior Medical and Nursing staff, depending on the condition of the patient. Findings should be clearly documented.

5. *Management of complications*

After clinical assessment, appropriate investigations including imaging should be performed in a timely manner. Often this may involve consultation with other Specialists, particularly Radiology, Vascular and/or other Orthopaedic Surgeons. This should be documented.

Decision-making or subsequent management should be based on all of the above factors.

6. *Institutional Factors*

Facilities These include appropriate Operating Theatres, Recovery Room and Ward.

Staffing Appropriately trained Theatre, Junior Medical and Paramedical staff, P/T, O/T etc. Consultant Orthopaedic Staff to provide Peer Support and supervision particularly where the surgeon is relatively junior or acting as a Locum. Ideally there should be two or more other Surgeons at the Institution and in situations where other surgeons are away on vacation or due to illness, the Organisation should arrange alternative support and/or supervision from a neighbouring or other Centre.

Support Specialities particularly General Medicine, Radiology and Vascular.

Question 2 'Did [Dr B's] care meet these standards?'

As mentioned above this is considered with relationship to the various phases of the care of the patient.

1. *First Consultation*

This was on the 28th April, some seven months prior to surgery. There is some question as to whether the patient was seen on only one occasion by [Dr B]. There was very, very brief documentation of this consultation and there was no mention of clinical findings or of discussion concerning other surgical options.

2. *Pre-operative Assessment*

As mentioned above there is no indication that the patient was seen again prior to surgery although it is possible that she was. Certainly most surgeons would arrange to see the patient closer to the time of surgery. [Dr B] in his submission stated 'another orthopaedic surgeon had assessed her case and upgraded her clinical priority to the most urgent' (page 12). There is no documentation that I could find which outlined any pre-operative planning.

A consent form was signed by [Dr B] and the patient on the 28th April, which is seven months preoperatively. There was no documentation of the specific complications that were discussed or confirmation that [Dr B] had a full appreciation of the difficulties of the surgery in this particular patient given her

obesity (130 kg). There is no mention of consultation with other more experienced colleagues or any specific preoperative planning. In particular, reference to specific implants or equipment and the need for an experienced assistant in this case.

I assess this aspect of the case with moderate to severe disapproval.

3. *Operative Procedure*

There is no information available to indicate [Dr B's] previous training or experience in performing total knee joint replacements. However I am aware that he had recently graduated and it is assumed that he did not have a wide experience in such cases.

The operation note is relatively brief and did not indicate any major difficulties during the surgery. However there is a mention of difficulty everting the patella. In addition on page 00008 it is stated 'when the components were trialled she had significant hyperextension at the knee'. It appears that this was corrected using a large tibial component.

There is documentation that the operation took longer than expected, that is, two hours twenty minutes of tourniquet time, and the intraoperative nursing record that the duration of the list was some five hours five minutes (which would include from the time that the patient came to the operating theatre until the time that the patient was released.)

It appears that on release of the tourniquet there was 'some bleeding as would be expected following tourniquet release, but this was controlled with diathermy blood vessels within the operative field.' Thus there is no indication from the record that there was excessive bleeding at the time. Postoperatively two Redivacs drained 440ml, which is certainly not excessive for a knee replacement. I also note that [Dr B's] assistant was 'another surgeon' but it is not clear and unlikely that this was an orthopaedic surgeon.

The postoperative instructions were brief and did not specify vascular observations although these were carried out, presumably as part of a protocol.

In summary therefore, based on the operative note, there is no indication that any major complication such as vascular injury occurred, although quite clearly the operation was difficult and prolonged.

4. *Postoperative Assessment*

(a) [Dr B] documented that the patient was seen in PACU. He noted 'it was difficult to feel pulses in either foot but the posterior tibial pulse could be located easily with Doppler'. This indicates to me that there was some attention directed towards the vascular supply to the foot at this stage.

(b) Day 1 — [Dr B] saw the patient three times at 8.45 in the morning, 2.00 in the afternoon and late in the evening and also was contacted by

the night house surgeon. This is somewhat unusual and reflects concerns, specifically some concern about the variable vascularity of the foot. Doppler assessments however at this time showed an audible pulse present on each occasion.

I also note that the patient complained of a painful calf and it was noted that there was a presence of an indentation in the calf. This was ascribed to pressure from a bolster and possibly related to the heavy leg. I note that it was documented that there was pain in the calf on passive dorsiflexion and that this was apparent even though epidural anaesthesia was working. Despite this, there is no mention that the calf pain could possibly be due to vascular insufficiency or ischaemia of the calf muscles.

In summary [Dr B's] assessment at this stage appeared to have been adequate in terms of the timing but not in the accuracy of assessment.

(c) Day 2 — The patient was seen on two occasions by [Dr B]: at 0820 before he left for [the orthopaedic clinic], and then later on his return. During the day the patient was frequently seen by house staff who discussed with [Dr B] the clinical findings. Based on this an ultrasound assessment was performed. I also note that the epidural which had been functional at that time was stopped in the morning of day 2.

The ultrasound was performed at 1430 on the 9th November and was interpreted by clinical staff as being somewhat encouraging. This is documented. The Radiologist reported the study as 'the examination is very limited.' Also it is stated 'arterial flow was noted in the popliteal fossa but it was difficult to identify the arterial vessels above and below. An arterial vessel with good flow was also seen in the medial aspect of the calf.' In summary it was documented 'there is no evidence to suggest a DVT and there appears to be satisfactory arterial flow in the popliteal fossa and into the medial aspect of the calf'.

It is unclear whether [Dr B] actually spoke to the Radiologists although the junior resident medical officer documented that the Radiologists should be asked 'what would be the most appropriate imaging'.

I would comment at this stage that there was very adequate and impressive documentation of the clinical findings by junior medical and nursing staff during this phase.

By late afternoon there was considerable concern by the nursing and junior nursing staff as to the status of the vascular supply to the foot and this was relayed to [Dr B] who reviewed the patient after his return

from [the orthopaedic clinic]. There is very good documentation by [Dr B] who concluded that the clinical findings could be explained by 'vascular spasm affecting the right foot? Secondary to tourniquet time — pressure of calf on bolster'.

In my view, at this time, there was a very clear indication of clinical signs of advanced vascular insufficiency which possibly had been limited by the presence of the epidural anaesthesia prior to this.

This was a critical decision time but there is no indication that there was any consultation with vascular or other surgeons at that time and no further action was taken that evening.

In my view the failure to consult with vascular or other surgeons at that time should be considered with severe disapproval.

(d) Day 3. At 0830 the patient was seen by [Dr B] who immediately made arrangements to transfer the patient to [Hospital 2] after discussion with the Vascular Surgeons.

In summary I feel that there were deficiencies on the part of [Dr B].

In the preoperative assessment, there was a deficiency of documentation with the reference to clinical findings. As mentioned above, I feel that [Dr B] depended largely on the previous assessments by others. There is no indication [Dr B] understood the complexity of total knee replacement surgery in this particular patient.

In the postoperative phase, as mentioned above, there was a misinterpretation of the clinical findings but there were certain distractors present, particularly the indentation of the calf. This will be discussed later. Again the dependence and reliance on the Doppler findings was a distractor as was the reliance on ultrasound findings, particularly with respect to the statement that there was 'satisfactory arterial flow'.

Question 3. 'How did the damage to the artery occur?'

This is uncertain but there is no doubt that the Popliteal Artery was damaged as the Operation Note from [Hospital 2] on 10th November 2005 (p 00136) clearly states 'External trauma to Popliteal Artery at level of Knee Joint. Too badly damaged for 1° (Primary) repair'. The possibilities include (see references below).

1. Posterior placement of retractors especially lateral.

2. Hyperextension of the knee after osteotomies, particularly of the tibia.

3. Direct injury to an artery with a sharp instrument.

In my view the most likely explanation was the hyperextension of the knee after the tibial bone cuts had been made possibly aggravated by the very heavy leg causing hyperextension.

It seems unlikely that direct injury with a sharp instrument occurred as there was no major bleeding after tourniquet deflation as one would expect. Bone cuts with the saw are usually made with the knee flexed which displaces the Artery posteriorly and thus protects it.

References

1. James T Ninomiya et al. Journal of Arthroplasty. 14:7 pages 803 – 809, 1999 (Injury to the Popliteal Artery and its anatomical location in Total Knee Arthroplasty).

2. Donna E Smith et al. (Arterial complications and Total Knee Arthroplasty). Journal of American Academy of Orthopaedic Surgery, Vol 9 – 4. pages 253 – 257, 2001.

Question 4. 'Is this something that could have been foreseen and/or avoided?'

In my view this was probably not foreseen and therefore avoided.

Question 5. 'Was there an untimely delay in referring [Mrs A] to [Hospital 2]?'

I believe there was an untimely delay in referring [Mrs A] to [Hospital 2].

However there were a number of factors which combined to lead to this delay. Namely:

a) The presence of a pedal pulse intermittently as detected by a number of different observers. This was not appreciated but probably was due to a good collateral circulation.

b) Finding the pulse on Doppler examination repeatedly.

c) Possible masking of the symptoms and signs of ischaemia by the epidural block which was not discontinued until midway through day 2.

d) The indentation in the calf ascribed to the bolster.

e) The report of the ultrasound examination which stated that there was satisfactory flow in the popliteal fossa and an artery in the medial calf. I understand that this can be present through collateral flow in the Medial Inferior Geniculate Artery but this was not mentioned in the report. Moreover, even though the Radiologist reported that 'the examination was very limited', an arteriogram was not suggested at that time.

f) A misinterpretation of the clinical signs which on day 2 were ascribed to 'vascular spasm affecting the right foot secondary to tourniquet time — pressure of the calf on the bolster.' (p 00028)

In addition I believe there was another very important factor — the lack of consultation with another colleague (Orthopaedic or Vascular Surgeon). I do not know the reason for this. It is not clear whether there were any other Orthopaedic Surgeons in Greymouth at the time. If so, why were they not consulted? If not, what arrangements had been made by the Department to provide Peer Support and advice — particularly for a young Locum Surgeon?

What arrangements for Vascular Surgical input and advice are available in Greymouth?

I suggest these questions to be directed to the DHB as they have fundamental implications for the provision of this surgery.

Question 6. 'Was it reasonable for [Dr B] to rely on results of the ultrasound to ascertain the blood flow?'

It would appear to be not unreasonable given the report of the Radiologist, but I suggest that the view of a Radiologist be obtained on this point. Again I state that the presence of another orthopaedic or vascular colleague for a second opinion would have been invaluable at that time.

Question 7: 'Should [Dr B] have included amputation as one of the risks associated with knee replacement surgery?'

Theoretically yes, but as the risk is so low (varying between 0.03% to 0.12% as stated in the literature) I am aware that a significant number of other orthopaedic surgeons in this country who perform total knee arthroplasty do not specifically mention amputation.

Additional Comment

As intimated previously, this most unfortunate case raises major concerns about Peer Support and supervision of young surgeons in small centres in New Zealand. They are often employed in locum positions at a time when they need

advice and encouragement, particularly when faced by difficult situations such as this one. Often there is a systemic deficiency on the part of the Employers, which needs the attention of all agencies involved — the D.H.B.s, the R.A.C.S. [Royal Australasian College of Surgeons], and the N.Z.O.A [New Zealand Orthopaedic Association].

I believe this to be the major factor leading to this most unfortunate complication."

Responses to expert advice

[Dr B's] response
[Dr B] responded to Dr Tregonning's advice as follows:

"Mr Tregonning voices concern about my relying on previous assessments of the patient. She was initially seen by [Dr F] on 22 March 2005. I believe you have this consultation on file. She returned to see him on 14 April 2005 as her condition had deteriorated. [Dr F] states that he lacked her clinical notes and X-rays and tried to bring her back to clinic in 2 weeks' time.

At that time [Dr F] was finishing a period [as a locum] and he had no further clinics in […] thus [Mrs A] was booked into my clinic.

I knew [Dr F] well from having worked with him in 2003 – 2004 in [Hospital 2] and working together closely as locums for 4 months [in early 2005].

At this time [Dr F] and I often assisted each other in theatre and in clinics.

I do not feel it was inappropriate to rely on the assessment of a colleague I knew well and worked closely with.

[Mrs A] did not see me as a first assessment nor for a second opinion but was placed in my clinic for follow-up as [Dr F] had no further clinics prior to his departure.

Mr Tregonning also voices concern that [Mrs A] was not seen closer to the time of surgery. In the public health system patients are often on waiting lists for many months. Many surgeons would not see the patient again from the time of them going on the waiting list until the day of surgery.

I usually prepare for knee replacement surgery by seeing the patient on the day of surgery and marking the limb to be operated on. I also give the patient the opportunity to ask any questions.

> Whilst in theatre, prior to operation I template the patient's X-rays to assess likely component size. I would also arrange bolsters on the table such that the knee would be supported in a flexed position, apply a tourniquet to the thigh, ensure intravenous antibiotics had been administered and a urinary catheter inserted if the patient was having regional anaesthetic.
>
> In the case of [Mrs A] the above preparations were done, a larger thigh tourniquet was obtained, an additional assistant was available and an entire half day theatre list was made available for this case alone.
>
> I saw [Mrs A] in [the orthopaedic clinic] on 28 April 2005. I saw her again on the orthopaedic ward, Greymouth Hospital on 7 November 2005 prior to her surgery. At that time I marked the limb to be operated on and confirmed she wished to go ahead with surgery. She had not had a premed that morning.
>
> …
>
> Special implants or equipment may be required in some cases particularly if there is unusual bony anatomy. Major deformity or bone loss may require implants with stems (which run inside the bone for greater stability in maintaining alignment) or augments (metal spacers to fill in areas of bone loss).
>
> A patient with much smaller or larger size bones than usual requires an appropriate sized implant. Hospitals often do not have these less common sized implants in stock and they must be obtained preoperatively from the manufacturers/distributors.
>
> Knees that are unstable due to lack of ligaments may require a more constrained implant.
>
> I did not feel any of these conditions applied in [Mrs A's] case. I planned to use an LCS knee implant, which was stocked in Grey Hospital and I was familiar with from my training in [Hospital 2].
>
> [Mrs A] was placed on the waiting list at a moderate, not high, priority. This meant she could be reassessed should her condition deteriorate. (As happened in this case.)
>
> When working as a locum your attachment to a hospital is temporary. I did not know if I would be the surgeon performing the surgery when I placed someone on the waiting list. Specific preoperative planning would not necessarily be helpful as, if the operation were done by another surgeon they might have a different choice of implant."

In relation to [Mrs A's] operative risk factors, [Dr B] stated:

> "Prior to surgery I discussed the risks of surgery. At that time I did not routinely discuss amputation. My common practice was to tell patients that knee replacement surgery was painful and usually took several months to recover from. I would warn them their knee might become a lot stiffer after the operation and that some patients continue to have pain.
>
> I would also routinely warn of the risks of infection (estimated at around 1% of cases) and that on occasion the knee replacement had to be removed to control infection. I also warned of the risks of blood clots which can be dangerous if they dislodge and travel to the lungs. This is known as a pulmonary embolism and is potentially fatal. (Although clots that cause no symptoms are common, the risk of a fatal pulmonary embolus is estimated at well under 1%). I also mention that the patient will receive injections to 'thin' the blood and reduce the chance of clots.
>
> Other risks routinely discussed included possibility of blood transfusion; that the patient might have a problem with anaesthetic (although I left it to the anaesthetist to discuss specific risks of anaesthesia); injury to nerves or blood vessels (although I did not, at that time, expand on this and mention amputation); and the possibility of any underlying medical condition being made worse by a big operation (so that a patient with heart disease might have a heart attack for example).
>
> In [Mrs A's] case I also explained that given her relatively young age she was likely to require a revision or 're-do' of the knee sometime in the future.
>
> This is a lot for a patient to try to remember. It was routine practice on the West Coast to give patients coming for hip replacement, knee replacement and carpal tunnel decompression, an information pamphlet about their surgery. There are, in fact, many more complications possible following knee replacement surgery. My aim when discussing possible complications was to make the patient aware that this was a major operation and to mention the most likely serious complications."

[Dr B] commented on the effect this case has had on his practice:

> "Since this case there have been some changes to my practice. I now warn patients of the possibility of amputation following arterial injury even though this is very rare. I have spent 6 months [overseas] doing an intensive Orthopaedic Fellowship in hip and knee replacements. I more strongly advocate obese patients to lose weight, although I would not deny a patient surgery if they were unable to do so."

Dr Dawe's advice
[Dr B] sought comment on the standard of care he provided to [Mrs A] from another orthopaedic surgeon, Dr Chris Dawe. Dr Dawe stated:

> "This report sets out to answer the specific questions [Dr B] asks.
>
> Question 1: 'I would like you to review Mr Tregonning's views generally, and in particular his statements about seeing patients three weeks before surgery which from my information is not standard practice throughout New Zealand.'
>
> I agree that seeing patients three weeks prior to surgery is not standard practice in hospitals throughout New Zealand. [Dr B] did review [Mrs A] in the outpatient department at Grey Base Hospital on 28/4/05, [Mrs A] having previously been seen by [Dr F] on 22/3/05, and 14/4/05. Although there is not great detail in [Dr B] 's letter of 28/4/05 it is very clear to me that [Dr B] did discuss with [Mrs A] the potential complications of knee joint replacement surgery, and I am quite sure that he was well aware of the potential problems with undertaking surgery on [Mrs A] given her weight. I accept that this was not specifically documented however. However, in mitigation, I would have to say that if the orthopaedic outpatient notes from any hospital in New Zealand were reviewed, for a patient being seen for a follow up visit such as this, a clinic note of this length would be very typical.
>
> I am of the view that [Dr B] was well aware of the potential problems in this case. I do not feel that there was any need for [Dr B] to review [Mrs A] three weeks prior to the proposed surgery, particularly as she was being admitted on the evening prior to surgery when she could be further reassessed and any aspects of the surgery then discussed.
>
> Mr Tregonning comments in his report on preoperative assessment, that 'there is no documentation of specific complications discussed, nor confirmation that [Dr B] stated prior to surgery I discussed the risks of surgery'.
>
> The correspondence from Grey Base Hospital dated 28/4/05 clearly states that [Dr B] discussed the potential complications of knee joint replacement with [Mrs A] that [she] understood these and wanted to proceed with surgery. While specific complications were not documented as I have outlined previously, this is often the case in many hospitals in New Zealand and would be regarded as appropriate practice.
>
> I would have to therefore disagree with Mr Tregonning's assessment of 'moderate to severe disapproval' of the preoperative assessment.
>
> Question 2: 'That [Dr B] relied on the clinical findings of another surgeon.'

On reviewing the records and reports I do not find any evidence that this is the case. [Dr B] clearly assessed [Mrs A] on 28/4/05. He did state that previous correspondence was not available, but again this is something that is not atypical in many outpatient departments through New Zealand, and I might add overseas where I have worked.

I can therefore not find any fault in the preoperative assessment by [Dr B], nor the fact that another surgeon upgraded the urgency for [Mrs A]. Given the circumstances of staffing in the Orthopaedic Unit at Grey Base Hospital I would have to accept this as being common practice, and probably not uncommon in other hospitals throughout New Zealand.

Question 3: 'Mr Tregonning's criticism on the lack of planning for special implants.'

I have not seen the preoperative X-rays, but I have talked to [Dr B] about these, and he assures me that there was a normal pattern of medial compartment osteoarthritis without any deformity or other concerning features. This is reinforced by the comments from [Dr F], Orthopaedic Surgeon, in correspondence dated 22/03/05 that the X-rays showed moderately severe medial compartment osteoarthritis. There were no other features noted. In particular there was no comment about mal-alignment, or significant bone loss, two features that would have necessitated special implants or other implants to be available.

I can therefore see no evidence that the preoperative planning was inadequate in this case in terms of special implants or other equipment that would be needed for the surgical procedure.

Operative Procedure:

Clearly this was a difficult case given [Mrs A's] BMI, and [Dr B] did make the point in his correspondence of 18/8/06 that this was not a routine total knee replacement. The comment about the patella being difficult to evert due to the abundant soft tissues would be expected in this case. In my view the operation note does give adequate detail, and [Dr B] outlines the steps he undertook to correct the hyper-extension he found with the trial prostheses. In fact the difference between a 12.5mm tibial insert and the definitive insert of 15mm is only 2.5mm, so I find it hard to understand that the hyper-extension present with the trial insert would have been sufficient to cause an arterial injury. There are many circumstances in my own practice when I will change a trial insert in this way.

Postoperative Assessment:

There is no doubt that [Dr B] assessed the circulation to [Mrs A's] leg on multiple occasions, using a number of different modalities including clinical assessment, Doppler assessment and an ultrasound scan. It would seem to me therefore that [Dr B] was particularly diligent in his assessment of the patient post surgery given the concerns about the circulation.

The distal pulses were felt to be present by a number of observers, and Doppler, as well as ultrasound imaging were used to assess the circulation. A confounding factor can be that there is often a very adequate collateral circulation about the knee, which may have resulted in the pulses being palpable and the Doppler being positive. However by day three post surgery, it was clearly obvious that the patient had developed an ischaemic limb and this was the reason for transfer to [Hospital 2].

In mitigation to the delay in transferring [Mrs A] to [Hospital 2] for further assessment and treatment, there are a number of factors that have to be taken into account in this situation. It is clearly very expensive; it does require significant organisational and logistic support as well as considerable inconvenience to the patient. I can therefore understand that [Dr B] needed to be absolutely sure there was a vascular problem that necessitated transfer.

This case has had a very poor outcome for [Mrs A], but I do feel there are a number of factors which have contributed to this, including the isolation of the West Coast, that the arterial pulses were palpable post surgery, the epidural catheter used for post operative pain relief may have resulted in a diminution of blood flow. All of these factors may have had a bearing on the outcome.

Finally I would have to agree entirely with Mr Tregonning's comments about the lack of peer support in Hospitals on the West Coast, and one of the major lessons that have to come from this case is that this is a situation that needs to be addressed and dealt with on an urgent basis."

WCDHB response

Dr C, senior orthopaedic surgeon at WCDHB, explained the support offered to locum surgeons at Grey Hospital:

"The surgeons employed as locums in 2005 all held a specialist orthopaedic qualification, namely a Fellow of the Australasian College of Surgeons (Orthopaedics) and were registered with the Medical Council as specialists in their own right. They therefore did not require supervision. As you suggested, consultations regarding difficult cases, was on an ad hoc basis.

> Regular X-ray meetings were held with the visiting Radiologist on a Friday morning, together with the other surgical specialities and Doctor [Dr B] did attend these X-ray sessions. In addition to this [Dr B] also presented an audit of all his work while he was at Grey Hospital at a meeting [at Hospital 2]. This meeting is attended by all the orthopaedic specialists, including the Professor of Orthopaedics, and the training registrars as well as the [Hospital 2] Radiologist. This is a formal audit meeting where the entire orthopaedic caseload for each individual specialist is presented by the specialist and all unexpected outcomes are discussed.
>
> I have included a copy of the West Coast District Health Board's credentialing policy. I can tell you that credentialing of the medical staff commenced in August 2004 and by October 2005 18 medical staff had been credentialed. The medical personnel credentialed up to that date were all permanent staff."

The Chief Executive Officer of WCDHB, Mr Kevin Hague, advised the following in relation to accessibility of the DHB's clinical records:

> "West Coast DHB has for some years been working towards a single electronic health record for all West Coast citizens. The aim is to ensure that a health professional who has legitimate reason to access a patient's clinical information can access all of this information across the full range of health services from wherever they personally sit in that range. This is congruent with the national direction of travel for health information, but West Coast DHB is further down this path than any other DHB.
>
> Significant progress has been made towards this goal, resulting in much better access for health professionals to clinical records in almost all locations.
>
> In the time since [Mrs A's] surgery PrISM (our system for coordination of delivery of MedTech 32 to all general practices owned by the DHB) has been bedded down and improved, our radiology service has been made completely digital, and we have introduced a new Patient Management System in secondary care (including laboratory). While there are some significant issues that are still being worked through (particular pharmacy and relationships with independently-owned general practices) our focus is now on providing an integrated view of all the information held at both primary and secondary levels, and the primary care version of this view is now operational (albeit with further enhancements still to be made)."

Further independent advice

On 4 July 2007, information supplied by [Dr B] and WCDHB was referred back to Dr Tregonning for review. Dr Tregonning provided the following statement:

"I make the following comments:

1. Report on [Dr B]

I accept that [Dr B] had performed some preoperative planning as outlined in his letter but again comment that there was no documentation of this.

It is somewhat reassuring that [Dr B] had discussed the case of [Mrs A] with [Dr C] 'in passing', but did not ask [him] to formally review the patient.

In the circumstances, [Dr B] as a Junior Locum Consultant faced with the very difficult clinical situation, would have been wise to ask [Dr C] to actually examine the patient, particularly on day 2 postoperatively, which was a critical time.

I note [Dr B's] experience in total knee joint replacement surgery which is in line with that of surgeons at [Dr B's] stage in his career.

2. Report of Dr Christopher Dawe of 29th June 2007.

I accept Dr Dawe's statement that 'seeing patients three weeks prior to surgery is not standard practice in hospitals throughout New Zealand.' I had used the term 'most surgeons etc' and am happy to change this to 'some surgeons or units'.

My personal view remains that it is best practice to review patients two to three weeks prior to surgery to identify potential problems close to surgery. This particularly applies if patients have not been seen for many months and I believe this particularly applies to this situation that [Dr B] was in [with] respect to [Mrs A].

With respect to preoperative assessment I accept that [Dr B] had probably performed this adequately but again I point out that there is no documentation of this.

3. The report of [Dr C] of the 26th June 2007.

i) I accept the fact that [Dr B] has the qualifications to work as a Specialist in orthopaedic surgery.

ii) It is clear that the surgeons at West Coast DHB attend and present their orthopaedic case load at the audit sessions in [Hospital 2].

iii) I note the credentialing policy of WCDHB and presume that [Dr B] had been credentialed, although there is no documentation of this.

Final Comment

Whilst I have identified there were a number of factors which I believe led to this most unfortunate clinical result (see below), the most important was the lack of peer support, both surgical and radiological for [Dr B] at the time that he was faced by a very difficult clinical scenario. I have noted, and this is supported by Dr Dawe, that this issue reflects the problems faced by small units in New Zealand. I again urge that the issue be addressed by the agencies involved namely the DHB, the RACS and the NZOA. With respect to the new information available and the comments of Dr Dawe, there is no further information or evidence to suggest that [Dr B] had a full appreciation of the difficulties of total knee joint replacement in this particular patient. As mentioned above I accept that [Dr B] had probably given attention to pre-operative planning and there is no doubt that consent for the operation was obtained but I still am not entirely satisfied with the documentation.

Taking all this into consideration I am prepared to change my judgement with respect to the first consultation and preoperative assessment from 'moderate to severe disapproval to 'some disapproval'.

Finally, I believe there was an untimely delay in referring [Mrs A] to [Hospital 2] and the reasons for this have been well identified in both my report of the 22nd January 2007 and Dr Dawe's report of 29th June 2007."

Advice from College of Surgeons and Orthopaedic Association
The Royal Australasian College of Surgeons (RACS) and the New Zealand Orthopaedic Association (NZOA) provided the following comments:

RACS advice
"Thank you for the opportunity to respond to the issues … regarding surgery in small centres.

While I can understand your concerns highlighted in the case at Grey Hospital, I think the case in question represents a unique set of circumstances of a relatively inexperienced surgeon and poor patient selection and I feel that the overall matter needs to be approached with considerable care. The particular situation in each small hospital around the country is going to be unique to that hospital and therefore I feel it may be difficult to provide general guidance …

The problem has been brought to your attention by a case involving the specialty of Orthopaedic surgery, but any review should also include General Surgery,

Otolaryngology, Plastic Surgery, Urology and Paediatric Surgery as well as perhaps including Ophthalmology and Gynaecology.

It may be oversimplifying the issue to look at the types of surgery which should only be carried out in a major centre. Rather, the College feels that matters such as patient selection (eg age, co-morbidities and BMI), surgeon 'selection' (eg age, experience, visiting vs permanent, length of locum), the appointments process and the credentialing process, surgeon mentoring/supervision and collegial support, as well as system issues, may be more important, and these are much more difficult to quantify.

The particulars of support for surgical procedures in smaller centres is an easier subject and could certainly be suitable for a review project, but it might be better to have more direct input from the Colleges concerned eg RACS and ANZCA, and possibly RANZCOG and RANZCO. I would anticipate setting guidelines for such areas as surgical review as part of the pre-assessment process, availability of an HDU, laboratory services, radiology services, nursing experience in theatre and on the wards, junior staff and after hours cover etc. If deficiencies were identified in these areas, they could show the DHBs where to concentrate their efforts. RACS has already been involved in a similar exercise with Ashburton Hospital in the mid 1990s.

Finally I would like to make the comment that we must continue to provide a very supportive environment for the smaller surgical hospitals in New Zealand. They and their medical and nursing staff provide a vital service to the people of rural New Zealand, and it is important that these services not be further limited by inflexible restrictions and regulations. By working together to build up the support services in these areas on the one hand, and to encourage closed supervision and mentoring of new surgeons on the other hand, I hope that we can achieve the goal of a safe small hospital environment for a broad number of 'routine' surgical procedures."

NZOA advice
"Thank you for inviting NZOA comments on … what support is needed before carrying out surgical procedures in a small centre.

The NZOA Executive is fully aware of the background to the West Coast case and has discussed this extensively. We believe that important lessons have been learned from this specific patient's poor outcome and, as indicated below, have taken steps to reduce the likelihood of similar future occurrences.

…

1. The problem is not the surgical procedure itself, but the operative indications, surgical expertise and support structure which includes anaesthetic services and nursing staff.

2. There is a huge variation in ability to undertake major surgical procedures in smaller centres. Some surgeons with particular skills and experience choose to work in a smaller centre and have developed around them an infrastructure accordingly. For example, the orthopaedic surgeons in Timaru carry out a high proportion of resurfacing hip joint replacements, a new and more demanding technique. …

3. We have difficulties attracting surgeons to the smaller centres and restriction of practice would have large implications for the populations, as practically all orthopaedic surgeons carry out emergency as well as elective work.

4. Larger orthopaedic centres are already having difficulty managing patient loads and if required to take on more cases from smaller centres there would be a blowout in increased waiting times and patients with less demanding surgical problems especially would suffer.

5. We already have unresolved difficulties with cross-boundary flow funding streams and transfer of patients would cause even more confusion. …

NZOA Executive believes … that surgeon judgement, experience and mentoring are the most important factors. We have started formal counselling of our graduates in the advisability of commencing their careers in smaller centres without senior support. While technically they are qualified to work anywhere, by virtue of Medical Council registration, they are encouraged to work where they have close mentoring, irrespective whether this is in a smaller or larger centre.

As well, we are drawing up guidelines for District Health Boards so that there is responsibility at local level for monitoring of new surgeons. All surgeons are credentialed for scope of practice and this needs to be strictly interpreted and enforced. Overseas trained surgeons especially need to be included in this process.

NZOA understands your responsibility and concern to improve patient outcomes and thank you for including us in your consultative process. We are very serious in our endeavours to ensure that the best possible orthopaedic service is offered to our patients at regional as well as metropolitan hospitals. …"

Response to Provisional Opinion

[Dr B] responded to my provisional opinion as follows:

> "I am disappointed that you consider me to have been in breach of the Code of Health and Disability Services Consumers' Rights.

I am far more disappointed at the serious complication suffered by [Mrs A]. I have spent a lot of time thinking about this case and discussing it with colleagues long before and subsequent to the involvement of the HDC.

I have reviewed my practice following this event although the report obtained from Mr. Garnet Tregonning outlined other areas, prior to surgery, that needed review or better documentation. This has been taken into serious consideration.

Subsequent to this case I have undergone further training [overseas]. This was specifically in difficult hip and knee replacement under the guidance of [an internationally recognized expert]. (Regrettably, as I was [there] I did not receive [Mrs A's] initial enquiry to the West Coast DHB and was unable to reply to her questions at that stage).

Since my return to New Zealand I have a full-time permanent position which allows far better continuity of care to my patients than a locum attachment.

I work in a larger orthopaedic department which allows better access to second opinions from more senior clinicians. I have also been able to get a senior colleague to assist me with more difficult cases.

I have not had any further cases of arterial injury following surgery but am vigilant for this. I would have a far lower threshold for referring patients for a vascular opinion. With respect to your report I intend to forward a written apology to [Mrs A].

There are a few points I would like to clarify in your report.

Mr Tregonning considers my initial clinic note too brief and felt a review of [Mrs A] two or three weeks prior to surgery would be desirable.

Although you may agree, neither a longer clinical assessment nor a review prior to surgery would have been likely to have avoided this unfortunate complication.

The only way for me to have reliably avoided this complication would have been to refuse to operate. In retrospect of course I wish I had not gone ahead with this operation. As a general principle however, I still feel that a patient who is clearly suffering a lot of pain and disability should not be denied joint replacement surgery just because they are a difficult case.

In this individual case I still feel [Mrs A] should have been offered surgery but I should have sought the assistance of a more experienced surgeon.

> [Mrs A] states I told her that her weight would not be an issue. This is incorrect although she may have inferred this from my decision to proceed with surgery.
>
> Of course her weight was always going to be an issue and make her anaesthetic and her surgery more difficult.
>
> As you can see from her notes [Mrs A] was suffering significant pain and disability from her knee. I did not think her obesity should be used as a reason to deny her surgery that might provide pain relief and a return to better function. I regret that I was unable to obtain this for her. …"

Code of Health and Disability Services Consumers' Rights

The following Rights in the Code of Health and Disability Services Consumers' Rights are applicable to this complaint:

Right 4

Right to Services of an Appropriate Standard

(1) Every consumer has the right to have services provided with reasonable care and skill.
(2) Every consumer has the right to have services provided that comply with legal, professional, ethical, and other relevant standards.

Other Relevant Standards

Medical Council of New Zealand

Guidelines for the maintenance and retention of patient records (October 2001):

Introduction
Records form an integral part of any medical practice; they help to ensure good care for patients and also become critical in any future dispute of investigation.

1. Maintaining patient records

(a) Records must be legible and should contain all information that is relevant to the patient's care.

(b) Information should be accurate and updated at each consultation. Patient records are essential to guide future management, and invaluable in the uncommon occasions when the outcome is unsatisfactory.

Opinion: Breach — Dr B

Under Right 4(1) of the Code of Health and Disability Services Consumers' Rights (the Code) Mrs A had the right to surgical services provided with reasonable care and skill. Surgical services include preoperative assessment and planning, and postoperative care and consultation with other specialists if the situation demands. In addition there is an obligation under Right 4(2) of the Code to provide services that comply with relevant professional standards, including those set by the Medical Council of New Zealand in relation to documentation.

I obtained advice on this case from Dr Tregonning, an independent orthopaedic surgeon. Dr B provided comments on his care from Dr Dawe, another orthopaedic surgeon. While I have considered the views of Dr Dawe, I attach more weight to the advice from Dr Tregonning due to his independence from the parties to this investigation.

Preoperative assessment and planning
At the time Mrs A was admitted for surgery, she weighed 134kg and was being treated for hypertension. Dr Tregonning advised that the surgery would be more difficult due to Mrs A's size and required careful planning and consideration of the associated risks.

Dr Tregonning advised that Mrs A should have had a full clinical assessment before surgery. This should have included individual patient features such as build and clinical well-being. In his view, it would have been best practice to review Mrs A two to three weeks before surgery to identify potential problems close to the operation, particularly since it had been many months since Dr B had seen her. At that stage the implants, equipment and staff needed for the surgery could have been planned in consultation with other surgeons.

Dr B reviewed Mrs A as an outpatient at the orthopaedic clinic on 28 April 2005. He stated that he was well aware that a total knee replacement on someone of her size was anything but routine. Dr B also noted his concern at her relatively young age, which made it likely that the procedure would need to be done again at some point. He noted that these were factors which suggested that surgery should be deferred for as long as possible, however Dr B said that Mrs A had been classed as "urgent" by another surgeon due to the pain she was experiencing and related restrictions on her lifestyle.

Dr B identified a number of risks that he routinely discusses with patients and which he told Mrs A about. He recalls mentioning the risk of vascular damage but not the possibility of amputation. There was no discussion of the risks associated with Mrs A's weight, and she recalls being told that it would not be an issue.

Dr B did not see Mrs A again until 7 November 2005, the day of her surgery in Grey Hospital, when he marked her leg for surgery and confirmed that she still wanted to proceed. Both he and Dr Dawe expressed the view that it is not standard practice to see a patient two to three weeks before surgery, as suggested by Dr Tregonning. Indeed, it does not appear that WCDHB runs preoperative clinics of this sort.

It was on the day of surgery that Dr B carried out his preoperative assessment, assessing the likely component size, obtaining a larger thigh tourniquet, arranging for an additional assistant and booking an entire half day of theatre time. Dr Tregonning advised that this planning was probably performed adequately but noted that there was no documentation of it. There is no evidence that Dr B discussed potential problems with a senior colleague (such as Dr C) before surgery or arranged for an orthopaedic surgeon to assist him should problems eventuate.

In 2005 Dr B was a recently qualified orthopaedic surgeon who was relatively inexperienced at performing joint replacement surgery, having performed fewer than 10 total knee replacements unsupervised. In my view, given Mrs A's size, he should have consulted a more experienced colleague during the planning stage, and known who to call on if he got into difficulty during the surgery, or should complications arise postoperatively.

Dr Dawe considered that Dr B was well aware of the potential problems Mrs A's surgery presented and could find no fault with the preoperative planning. As noted above, Dr B said that he was aware that the surgery was not routine. However, I am more inclined to agree with Dr Tregonning's view that Dr B did not fully appreciate the difficulties of total knee joint replacement in Mrs A. If he had appreciated these difficulties, he should have discussed them with Mrs A rather than assuring her that her weight was not an issue. Nor is there any evidence that Dr B mentioned the additional theatre time required or the risks of prolonged surgery. It is well documented that patients who are morbidly obese are at greater risk of complications during surgery and in recovery.

In my opinion Dr B did not appropriately plan Mrs A's surgery. Mrs A's surgery presented a technical and clinical challenge. Dr B showed a lack of insight and judgement in deciding to undertake such surgery with the limited support services available at Grey Hospital. Before he proceeded, Dr B should have discussed her case with a senior colleague at Grey Hospital, arranged for back-up support from other specialists, and made Mrs A aware of the risks related to her weight. The deficiencies in Dr B's planning amount to a failure to provide services with reasonable care and skill, and a breach of Right 4(1) of the Code.

Postoperative care

I accept that Dr B and the junior medical staff and nurses were vigilant in their observations of Mrs A after the operation. Dr B was clearly concerned about the circulation in Mrs A's leg. However, Dr Tregonning advised that observations were misinterpreted and a number of factors led Dr B and other staff to underestimate the degree of arterial compromise in Mrs A's right leg.

For example, the intermittent pedal pulses felt by many of the staff and the arterial flow noted on the ultrasound could just as likely be due to "good collateral blood flow" as arterial blood flow. The indentation of the calf was attributed to the bolster cushion which supported her leg during surgery, while Mrs A's epidural analgesia was likely to mask the signs and symptoms of ischaemia. It seems that significance was not attributed to the worsening colour of Mrs A's leg, as noted by Dr G's notes between 9am and 2.30pm on 9 November.

The ultrasound on the second postoperative day was "very limited" due to the size of Mrs A's leg, and the fact that Grey Hospital did not have the appropriate radiology equipment to reliably detect vascular damage. When Dr B examined Mrs A later that day, he attributed her worsening symptoms to vascular spasm, the result of extended tourniquet time during her surgery. Dr B adopted a wait and see approach, when urgent treatment was called for.

Dr B was attentive to Mrs A in the three days before her transfer to Hospital 2, noting observations and results. I accept that Dr B was considering the possibility of arterial insufficiency and sought to eliminate less serious explanations for Mrs A's condition. However, by the evening of the second postoperative day, the junior doctors and nursing staff were clearly concerned, yet Dr B did not discuss her with more senior colleagues or arrange her transfer for a vascular opinion. In my view he should have asked Dr C to assess Mrs A, and consulted his colleagues at Hospital 2 when he returned from the orthopaedic clinic on the afternoon of 9 November. He should also have telephoned the radiologist, Dr D, that afternoon to discuss the ultrasound findings in more detail, instead of waiting until the next day to do so. In Dr Tregonning's view, by this time there was a very clear indication of clinical signs of advanced vascular insufficiency. This was a critical decision time. The failure to consult with vascular or other surgeons was a major omission on Dr B's part.

Drs Tregonning and Dawe agree that the isolation of the West Coast played a significant part in this unfortunate outcome. The expense and logistics of transferring patients from Greymouth to Hospital 2 made it important that Dr B be reasonably certain of his diagnosis before arranging the transfer. In Dr Tregonning's view, the most important factor in the unfortunate clinical result for Mrs A was the lack of peer support "both surgical and radiological for Dr B at a time that he was faced by a very difficult clinical scenario".

Conclusion re standard of postoperative care
In summary, Dr B did not provide postoperative care of an appropriate standard in a number of ways. First, on the evening of 9 November he failed to identify the seriousness of the clinical signs in Mrs A's leg, as it became more ischaemic. Despite being consulted on a number of occasions by junior doctors he only mentioned "in passing" the case to a senior colleague, Dr C. Had Dr B asked Dr C to review the case, or sought advice from the vascular team, Mrs A's condition may have been identified earlier. I accept Dr Tregonning's advice that this was a "critical decision time". Dr B's lack of experience appears to have compromised his judgement and delayed her transfer. I have considered the mitigating factors raised by Dr Tregonning and Dr Dawe in relation to the lack of support for Dr B. I have also considered the fact that he did not make use of the support that was available. In all the circumstances, I consider that Dr B breached Right 4(1) of the Code by failing to provide postoperative care of an appropriate standard to Mrs A.

Documentation
Dr Tregonning has been critical of Dr B's documentation. As a clinician, particularly one working in an isolated rural community with clinics at different locations, Dr B had a professional obligation to keep comprehensive records. The Medical Council acknowledges the importance of medical records in its *Guidelines for the maintenance and retention of medical records*: "Patients' records are essential to guide effective management, and incalculable in the uncommon occasions when the outcome is unsatisfactory."

There were important preoperative considerations for Mrs A. Dr B said Mrs A's knee replacement was far from routine, but did not document his reasoning or the additional surgical preparations he had undertaken. Dr Tregonning said that the profession would view this with "some disapproval".

Furthermore, Dr B's operation notes should have been more comprehensive. In terms of recording the surgical procedure, Dr Tregonning said:

> "The operation note should clearly document the steps of the operation including some reference to positioning, the pressure and time of inflation of the tourniquet, the approach and implants used and the details of closure. It should also include any difficulties or unusual occurrences during surgery.
>
> There should be clear and adequate postoperative instructions including assessment of neurovascular function."

In relation to this standard, Dr Tregonning said Dr B's operation note was "relatively brief and did not indicate any major difficulties during surgery". There was some difficulty with the patella (knee cap) and "hyperextension of the knee", and the operation also took longer than expected. The tourniquet time of two hours and 20 minutes was not recorded. Dr B's postoperative instructions were brief and did not

specify vascular observations. There is no reason to suspect vascular injury occurred during surgery "although quite clearly the operation was difficult and prolonged". This is not recorded in Mrs A's notes. Dr Dawe disagreed with Dr Tregonning, stating that Dr B provided sufficient detail in his operation notes, compared with the notes kept by other surgeons he has encountered.

Relevant and accurate documentation is a key means of ensuring that health care services are appropriate and coordinated, particularly when the surgeon, who is the decision-maker in patient management, is not always readily available. It is evident that Dr B was concerned about Mrs A's circulation, first assessing her in the recovery room and following up with three visits the next day, all with particular attention to the blood flow to her foot. But he did not document what he was looking for, or his reasons for his concern in her postoperative records, and then did not alert others in the team caring for her.

Accordingly, Dr B's documentation did not meet professional standards and he breached Right 4(2) of the Code.

Opinion: No breach — West Coast DHB

As a health care provider, WCDHB is subject to the Code and had a duty to provide Mrs A with surgical services of an appropriate standard. As Dr B's employer, WCDHB also had an obligation to take reasonable steps to prevent him breaching the Code.

Direct liability
Having considered the information gathered during this investigation and the expert opinions provided, in my view there is nothing to suggest that the perioperative services provided by WCDHB were not of an appropriate standard. Therefore WCDHB did not breach the Code in this respect.

Vicarious liability
In addition to any direct liability for a breach of the Code, employers are vicariously liable under section 72(2) of the Health and Disability Commissioner Act 1994 for any breach of the Code by an employee. Under section 72(5) of this Act, it is a defence for an employing authority to prove that it took such steps as were reasonably practicable to prevent the act or omission of employee which breached the Code.

WCDHB necessarily relies on short-term locums to fill vacant surgical positions. Dr B was employed by WCDHB as a locum orthopaedic surgeon, as were the other orthopaedic surgeons who saw Mrs A. At the time of these events he was fulfilling a

two-month contract. Dr C did not consider that Dr B required supervision, but he was available for consultation if necessary.

Between 2001 to 2004, Dr B undertook advanced training in orthopaedic surgery which included him assisting with over 100 knee replacements. At the time of Mrs A's surgery he had performed fewer than 10 knee replacements (unsupervised) as a consultant orthopaedic surgeon. This meant that Dr B was a qualified but relatively inexperienced surgeon. While he was no doubt technically sound, he lacked the experience to deal with a complicated clinical situation such as Mrs A's.

Credentialing of medical staff began at Grey Hospital in August 2004 and by October 2005, 18 permanent medical staff had been credentialed. This did not include Dr B or any other locum. However, Dr B was able to attend sessions which the visiting radiologists gave every Tuesday morning, and had his work audited by Hospital 2 specialists at the time. Dr C described this as "a formal audit meeting where the entire orthopaedic caseload for each individual specialist is presented by the specialist and all unexpected outcomes are discussed". However, on a day-to-day basis Dr B had no collegial support or supervision unless he specifically requested it.

WCDHB recognises and tries to overcome the geographical isolation locums face by providing an information pack to its new doctors, and having comprehensive policies on the orientation of orthopaedic surgeons and notes for the guidance of senior medical staff. Dr B was oriented to WCDHB and its services in January 2005. He was given a folder of information, shown around the theatre and wards, and introduced to senior staff. Dr C also discussed how the orthopaedic service was run.

Dr B decision to perform Mrs A's surgery in Greymouth Hospital was a clinical one. In my view, it was reasonable for WCDHB to rely on Dr B's clinical knowledge and judgement. Dr B knew that he could consult Dr C but chose to mention Mrs A's case to him only in passing. Dr B was also aware of how to contact a vascular specialist at Hospital 2 and did so, although belatedly. After examining all the evidence, I am satisfied that WCDHB took reasonable steps to ensure Dr B was inducted into its services and able to provide safe surgical services. Accordingly, WCDHB is not vicariously liable for Dr B's breach of the Code.

Surgical services in remote areas and smaller centres

I have found WCDHB not directly or vicariously liable in this case. However, there are some questions about the level of support WCDHB offers locum surgeons in Dr B's position. Dr Tregonning and Dr Dawe, experienced orthopaedic surgeon consultants, commented on the situation in isolated rural hospitals throughout New Zealand. In their view newly qualified, but inexperienced, vocationally registered doctors should not be working in isolation at a time when they need supervision and collegial support. In this case, more readily available vascular and radiology specialist input would clearly have been valuable.

I am grateful for the thoughtful advice that I have received from the Ministry of Health, the Royal Australasian College of Surgeons (RACS) and the New Zealand Orthopaedic Association (NZOA) on this case. I endorse the NZOA comment that "surgeon judgement, experience and monitoring are the most important factors" and the emphasis placed by RACS on the need for proper support services to be available when surgical procedures are undertaken in remote areas or smaller centres.

As noted by the Ministry of Health, the case also raises the broader issue of credentialing both surgical services provided by district health boards (especially in remote areas or smaller centres) and the surgeons who work in such services. Determining what range of surgical services can safely be offered on a particular site (supported by appropriate support services) is a key issue for all district health boards. A regional perspective on service planning and collaboration between neighbouring district health boards is critical.

District health boards in areas such as the West Coast do not rely on locum specialists by choice, but rather as a result of difficulties in recruiting appropriately qualified permanent staff. Reliance on locums raises a number of issues, for example ensuring that they are sufficiently familiar with the systems at that district health board, available resources and support and issues in the community. Where a locum is not very experienced, there is an increased need for support to ensure that they are able to provide appropriate care to patients. I am concerned by the somewhat "hands off" approach to providing support to Dr B. It is important that senior medical officers at WCDHB take a proactive approach and provide collegial support and mentoring to visiting medical staff, particularly relatively inexperienced doctors such as newly qualified specialists.

Another issue regarding the isolation of doctors working in remote areas was raised by Dr Dawe. He observed that the decision to transfer a patient to a major centre is not taken lightly, because of the difficulty imposed on the family, the expense and logistics involved. It is likely the deciding doctor will try to eliminate less serious causes when urgency is needed. Under those circumstances precious time is lost. In retrospect, it would have been safer for Mrs A to have her surgery performed in a larger hospital in a major centre.

A further issue in this case was that none of the doctors seeing Mrs A had access to a full set of her notes, because her outpatient notes were stored at the orthopaedic clinic, and her inpatient records in Greymouth. It is essential that clinicians are able to access a full set of clinical records at all the main locations where WCDHB provides services. It is encouraging to see the significant progress WCDHB has made in working towards a single electronic health record for all West Coast patients.

Recommendations

Dr B
I recommend that Dr B review his practice in light of this report and confirm that he has discussed the report with the Head of Department of the district health board where he is currently employed.

West Coast DHB
I recommend that WCDHB remind senior medical staff of their responsibility to take a proactive approach and provide collegial support and mentoring to new and visiting medical staff.

All district health boards
I recommend that all district health boards, prior to the appointment of any surgeon to a consultant position (when that surgeon is newly qualified or has not worked at consultant level in New Zealand for at least 12 months), whether on a permanent or locum basis, seek advice from the relevant surgical society or the Royal Australasian College of Surgeons as to the suitability of the proposed appointment, and whether any special support will be needed.

Ministry of Health, District Health Boards and Royal Australasian College of Surgeons
I recommend that the Ministry of Health, all district health boards and the Royal Australasian College of Surgeons (RACS) work together to develop and implement a plan to address the issue of credentialing surgical services provided by district health boards (especially in remote areas or smaller centres) and the surgeons who work in such services. This process should include consideration of:

- what support services are needed before surgical procedures can safely be undertaken in remote areas and smaller centres in New Zealand;
- the need for a regional perspective on service planning and collaboration between neighbouring district health boards.

I request that the Ministry of Health report to me by **31 May 2008** on progress in implementing this recommendation.

Follow-up actions

- A copy of this report will be sent to the Medical Council of New Zealand, the Director-General of Health, the Royal Australasian College of Surgeons, and the New Zealand Orthopaedic Association.

- A copy of this report, identifying only Grey Hospital and the West Coast District Health Board, will be sent to all district health boards and placed on the Health and Disability Commissioner website, www.hdc.org.nz, for educational purposes.

Names have been removed (except Grey Hospital and West Coast DHB) to protect privacy. Identifying letters are assigned in alphabetical order and bear no relationship to the person's actual name.

Appendix 1

Dr B's operation note stated:

"***OPERATION:*** ***Right total knee joint replacement.***

INDICATION: This 48 year old woman has had long standing problems with pain in both knees, worse on the right. Her X-rays show primarily medial compartment disease. She has not responded to non-surgical management. Brought forward for right total knee joint replacement. Of note [Mrs A's] BMI is > 40.[7]

PROCEDURE: Cefazolin IV prophylaxis. Tourniquet right thigh. Betadine paint up sterile drape.

Medial parapatella approach was made. Patella eversion was difficult due to the abundance of soft tissues.

Using LCS instruments the tibia was prepared to accept a size 2.5 tray and the femur to accept a standard femoral component. Although originally the plan had been to use a 12.5 mm rotating platform when the components were trialled she had significant hyperextension at the knee. A 15 mm component was inserted. With this there was a good range of knee movement, patella tracking appeared appropriate and the knee would extend but not hyperextend.

Pulsatile lavage washout. Components cemented into position. Further 2 litre pulsatile lavage. The tourniquet was deflated. Two redivac drains were placed within the wound. The wound was closed with 1 vicryl to repair the extensor mechanism. 2/0 vicryl to fat layer, 3/0 monocryl subcuticular to skin.

[Mrs A] was reviewed in the PACU. The right foot was well perfused. It was difficult to feel pedal pulses in either foot although the posterior tibial pulse could be

[7] Body Mass Index greater than 40; average BMI is 20 to 25.

located easily with Doppler. She was moving her right foot well.

POSTOP INSTRUCTIONS: IV Antibiotics
Anticoagulants
Removal of drain tomorrow
Mobilise weight bearing as able."

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