

Decrement Time Does Not Correspond to Wakeup Time in Paediatric Total Intravenous Anaesthesia With Propofol and Remifentanyl

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Introduction

Total Intravenous Anaesthesia (TIVA) use in children is becoming increasingly popular¹. Modern TCI pumps can be programmed to display Decrement Time (DT). This is the calculated time for the estimated plasma propofol concentration to fall to an arbitrary value programmed into the pump. Inexperienced TIVA users assume this to be equivalent to the wakeup time (WT) for the patient at the end of surgery. Pumps at Birmingham Children's Hospital are programmed with a decrement propofol concentration of 1.5µg/ml, therefore DT estimates how long it will take for the plasma concentration to fall to this value once the propofol infusion is stopped. This is specific for the model being used.

Aim

The aim of this audit was to demonstrate that the Decrement Time cannot reliably estimate Wakeup Time in individual patients.

Method

Patients undergoing TIVA with a Carefusion TCI pump were studied. Exclusions included patients less than 6 months old or with an underlying condition that might delay wakeup. Data was collected on demographics, anaesthesia, DT and time to movement, airway device removal and eye opening. Time to eye opening was considered equivalent to WT. Median, Range and Interquartile Range were calculated for relevant data. The Median Absolute Deviation was also calculated for the difference between DT and eye opening. The Pearson correlation coefficient was calculated for DT and time to movement, time to airway removal and time to eye opening, respectively.

Results

Data was collected from 55 patients undergoing a variety of surgical procedures. Table 1 shows the demographic data for the patient sample.

Age (years)	7.2 (0.9-15.9)
Weight (kg)	26 (8.5-77)
ASA status:	
1	22
2	14
3	18
4	1
Specialty:	
Lines	19
PSU	10
Ophthalmology	8
Orthopaedics	6
ENT	4
Others	8

Results

The Paedfusor model was used in 51 patients, with the Schnider model used in the remainder. Table 2 details the anaesthetic data for the procedures, reported as median and interquartile range.

Induction:		
Gas		19
IV		36
Propofol/remifentanyl mix		48
Propofol model:		
Paedfusor		51
Schnider		4
Airway:		
LMA		39
ETT		14
Nasal Cannula		2
Propofol target (mcg/ml):		
Initial		4 (3-4)
Maximum		4 (4)
Minimum		2.6 (2.5-3)
End		2.8 (2.5-3)
End remifentanyl (mcg/kg/min)		0.1 (0.08-0.13)
Duration of propofol/remifentanyl (mins)		58 (43-80)
Decrement time (mins)		11.75 (8.3-21)

Eye opening was always after movement and airway device removal in 78% of patients, but at the same time in the remaining 22%. Median DT was 11.75 minutes (IQR 8.3-21), whilst median time to eye opening was 15 minutes (IQR 9-20). Time to eye opening was less than the DT in 22 patients (range -24.5 to -0.2 minutes) and more than in 32 patients (range 0.25 to 19.75 minutes).

Figure 1 shows the relationship between DT and WT for all patients. The Pearson correlation coefficient (r) is 0.033 (n=55; p=0.81 (two tailed)). There was also poor correlation between DT and time to movement (r=-0.062; p=0.65), and time to airway removal (r=0.0008; p=0.99).

Figure 2 shows the values for the difference between DT and WT for individual patients. The Median Absolute Deviation for the difference between DT and time to eye opening was 5.75 minutes, with an IQR of -4 to 7.25 minutes. In 25 patients the DT and WT were within 5 minutes of each other.

Figure 3 demonstrates there was significantly better correlation between DT and duration of propofol infusion for patients with anaesthesia duration of less than 60 minutes. This was similar for the difference between DT and WT in this group (r=0.63; n=29; p=0.0002).

There was a strong negative correlation between the propofol plasma target concentration at eye opening and the time since surgery (r=-0.57; n=54; p<0.0001). Patients opening their eyes at a higher concentration had a significantly shorter time since the end of surgery.

Conclusion

This data demonstrates there is large variation between DT and time to eye opening in a significant number of patients anaesthetised with TIVA and that there is very little correlation between the two values unless the duration of anaesthesia is less than 60 minutes. The decrement time is an arbitrary value entered into the pump and cannot be used to reliably inform wakeup time in individual patients, particularly if the duration of anaesthesia is more than 60 minutes.

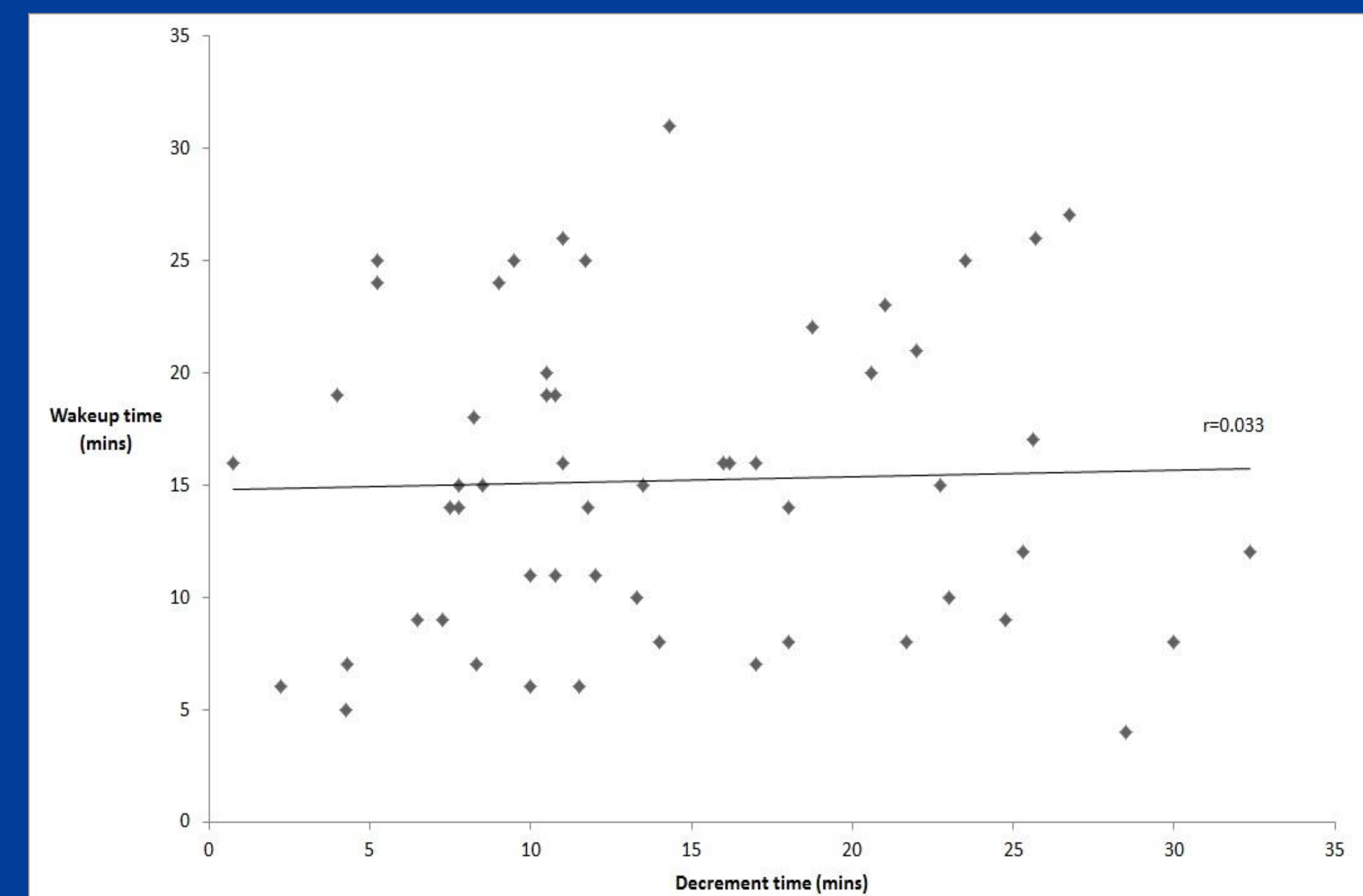


Figure 1. Plot of relationship between Decrement Time and Wakeup Time for all patients

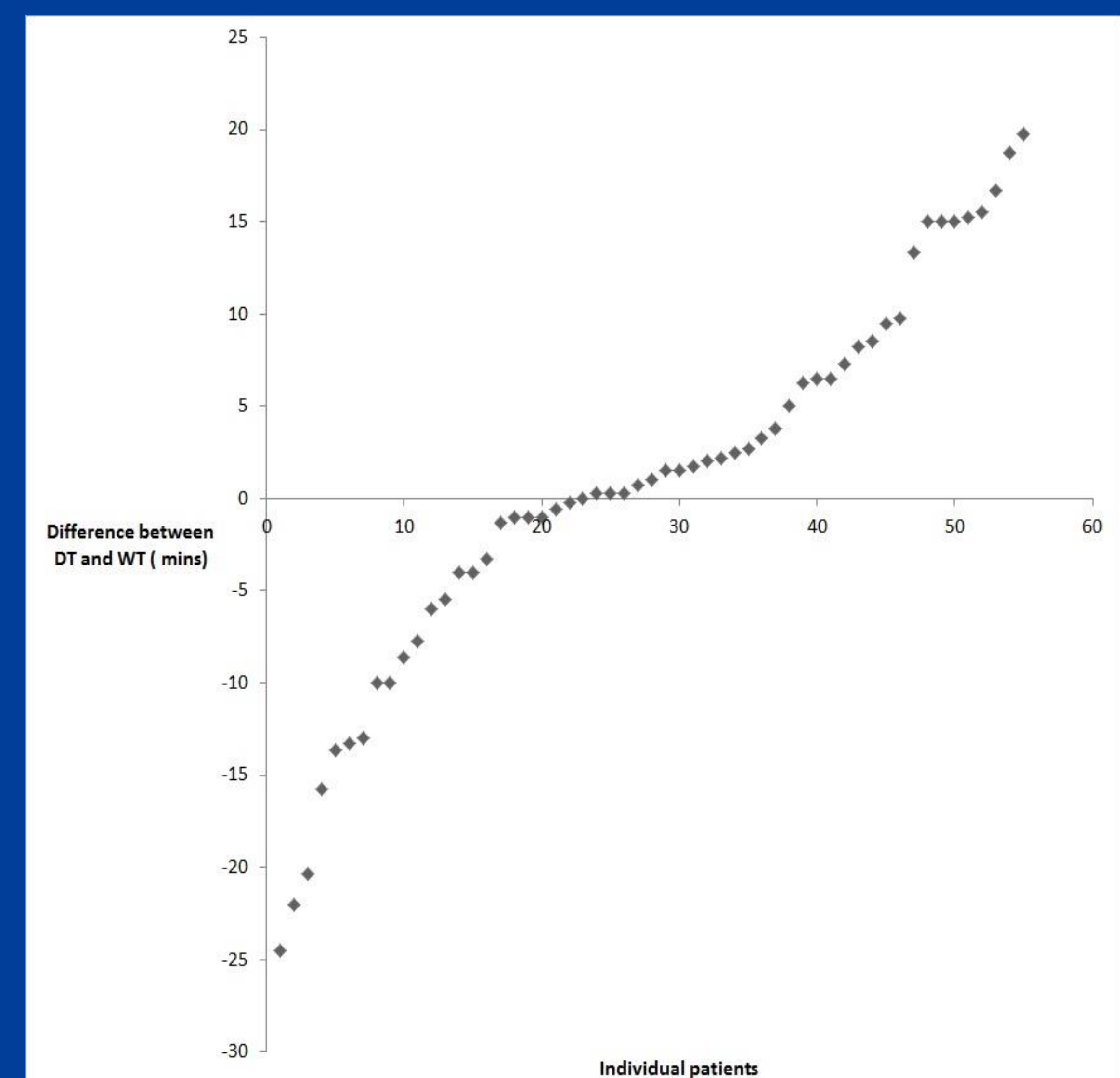


Figure 2. Plot of difference between Decrement Time and Wakeup Time for individual patients

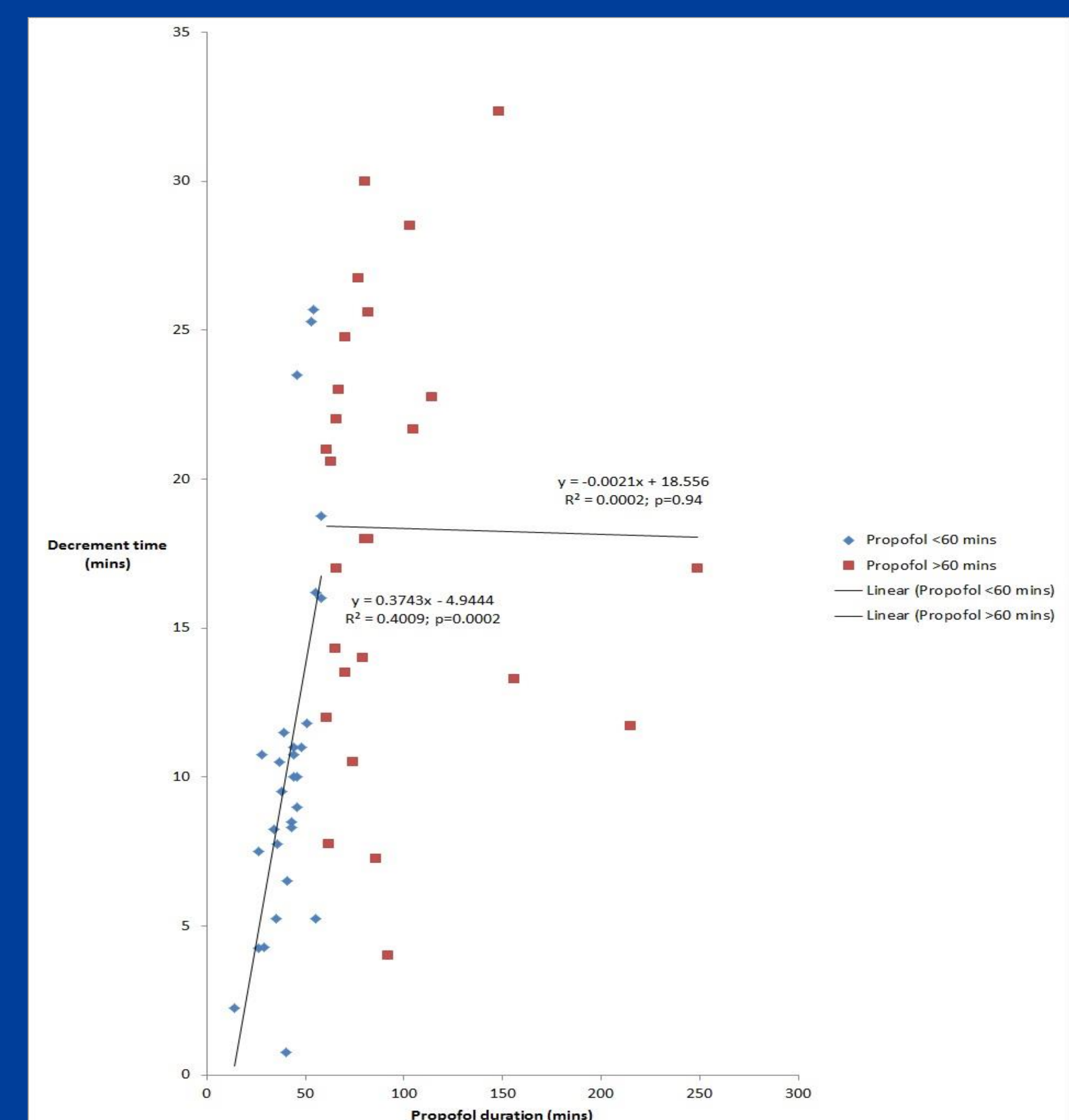


Figure 3. Plot of relationship between Decrement Time and propofol infusion duration for operations lasting less than 60 minutes and more than 60 minutes

Reference

Goh AN, Bagshaw O, Courtman S. A follow-up survey of total intravenous anaesthesia usage in children in the U.K. and Ireland. *Paediatr Anaesth*. 2019; 29:180-185.