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Case report

The role of monitoring platelet function perioperatively and platelet transfusion for operated spontaneous intracerebral hemorrhage patients with long-term oral antiplatelet therapy: A case report

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ABSTRACT

Introduction and importance: Spontaneous intracerebral hemorrhage (SICH) with long-term oral antiplatelet therapy (LOAPT) is known as a dilemma in balancing the risk of postoperative rebleeding and ischemic events because of confused coagulation function. We herein describe a report of perioperative management of spontaneous intracerebral hemorrhage patient on long-term oral antiplatelet therapy.
Case presentation: A 42-year-old male patient on long-term oral antiplatelet therapy presented with coma, and he was diagnosed with spontaneous intracerebral hemorrhage. Considering the patient's clinical condition, despite the thromboelastography suggested that the inhibition of platelet function was high preoperatively, an emergency craniectomy were underwent. After platelet transfusion during surgery and taking control of the clotting and platelet function postoperatively, the patient was stable without rebleeding and new ischemic events in perioperative period and recovered satisfactorily.
Clinical discussion: Rare studies have provided evidence for managing operated spontaneous intracerebral hemorrhage patients on long-term oral antiplatelet therapy, and whether platelet transfusion is recommended was controversial. In this case, we presented monitoring and taking control of clotting and platelet function postoperatively would help in preventing rebleeding and ischemic events in such patients; moreover, platelet transfusion may quickly and safely reverse platelet dysfunction for emergency surgery. This case was the first to report platelet function and coagulation function management in spontaneous intracerebral hemorrhage patients with long-term oral antiplatelet therapy.
Conclusion: Monitoring and maintaining coagulation and platelet function perioperatively are essential to balance the risk of postoperative rebleeding and ischemic events.

1. Introduction

As the population ages, the number of spontaneous intracerebral hemorrhage with long-term oral antiplatelet therapy patients continues to increase [1]. In such patients, many people miss the optimal timing of surgery due to the high risk of postoperative bleeding complication [2], even though emergency surgery is an effective way to reduce mortality [3–6]. On the other hand, some studies have shown that non-selective platelet transfusion not only couldn't improve outcome, but also increase ischemic events [7–9]. This is a medical dilemma for every neurosurgeon to treat such patient. In our case, we described a spontaneous intracerebral hemorrhage (SICH) patient on long-term oral antiplatelet therapy (LOAPT) performed an emergency surgery under monitoring the platelet function in an academic hospital and shared our experience in treating such patients.

2. Methods

This work has been reported in line with the SCARE criteria [10].

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3. Case presentation

A 42-year-old male patient presented with SICH to our medical institution (Being Tiantan Hospital/Beijing/China) in January 2020. The patient received two-month dual antiplatelet therapy for recent cerebellar infarction before SICH. Medication included aspirin (Bayaspirin® 100 mg, Bayer S.p.A) 100 mg daily and clopidogrel (Plavix® 75 mg, Sanofi Winthrop Industrie) 75 mg daily. The patient had no alcohol or drug abuse history, surgery or any other noteworthy prior medical history, drug history, significant family history, and psychosocial history. Upon physical examination, the patient heart rate was regular at 50 bpm, blood pressure was 164/78 mmHg and body temperature was 37 °C. The Glasgow coma scale (GCS) [11] was 8 and modified Rankin scale (mRS) [12] was 5 at admission. An immediate computed tomography (CT) revealed a right frontotemporal hematoma with cerebral herniation. The preoperative laboratory examination demonstrated the routine blood tests and coagulation test as normal; However, the thromboelastography showed that platelet function was inhibited completely (citric acid kaolin (CK)-maximum amplitude (MA): 42 mm; the inhibition rate of arachidonic acid (AA%): 78%; and the inhibition rate of adenosine diphosphate (ADP%): 100%). Nine hours after SICH, an emergency craniectomy was performed to evacuate hematoma and decompress, with consent from the patients' family members and neurosurgeons. A ten-year experience neurosurgeon performed the procedure, and the corresponding author supervised this surgery. Ten hours after SICH, to improve the coagulation function, the platelet and plasma transfusion was performed during the surgery. Postoperatively, the patient was transferred to the intensive care unit (ICU). On the third day after the surgery, the thromboelastography showed that the ADP% decreased by 40% the AA% decreased by 24.8% and the CK-MA increased to 52 mm; and the routine CTs, which were performed postoperatively and on third and sixth day after surgery, didn't find the sign of rebleeding (Fig. 1). Platelet count declined continuously after surgery and reached a minimum of $51*10^9$/L on the fourth day after surgery but increased subsequently (Fig. 2A). Moreover, although activated partial thromboplastin time (APTT) and prothrombin time (PT) was acceptable (Fig. 2B), the significantly decreased fibrinogen (Fig. 2C) was found on the fifth day after surgery. However, because the fibrinogen and platelet count recovered shortly afterwards and there was no sign of rebleeding or new ischemic stroke in CT (Fig. 1), we didn't admit any special treatment. Notably, although the patient didn't restart antiplatelet therapy, there was no occurrence of special events later, and the patient was stable and recovered satisfactorily. Finally, the patient was discharged with GCS as 4 T6 and mRS as 4. The patient was followed up routinely three months after SICH via telephone, and the result suggested that the patient detached from respirator and the GCS was 15. Six months after SICH, telephone follow-up revealed that the patient's condition was further improved and the mRS was 3. The patient's family was satisfied with the treatment outcome and had good compliance with follow-up.

The work was approved by the Institutional Review Board of Tiantan Hospital, and the ethics committee number is KY2019–096-02. Informed consent was obtained for the case report, and privacy of patient has been effectively protected.

4. Discussion

Rebleeding and ischemic events were two focus in managing SSICH patients on LOAPT [13–15]; how to balance the risk of these two events would help in improve patients' outcome [16–21]. However, rare studies have provided evidence for managing operated SICH patients on LOAPT, and whether platelet transfusion is recommended was controversial

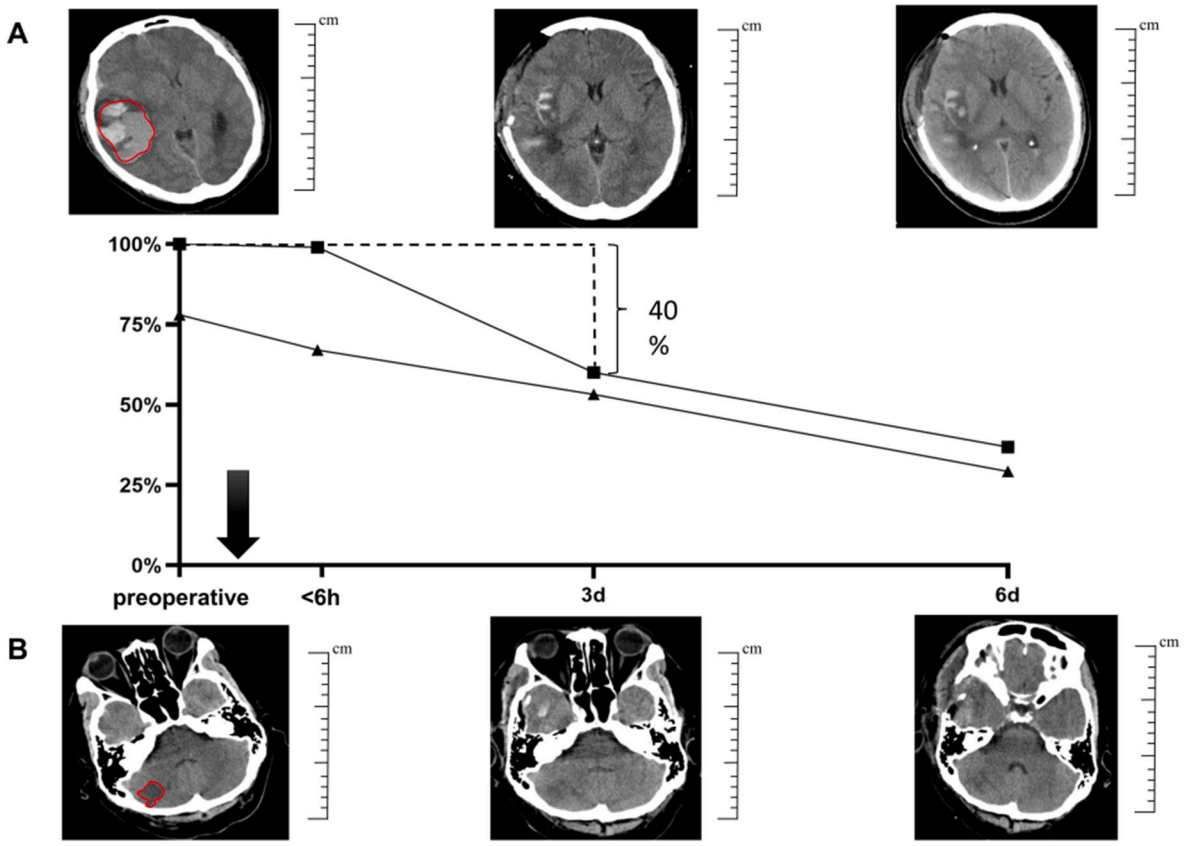

Fig. 1. Thromboelastography was used to monitor platelet function perioperatively. The patients had a high inhibition rate preoperatively. After the platelet transfusion, the platelet function was significantly improved on the third day postoperatively. Postoperative CT follow-up showed no bleeding or ischemic complications. (A: Intracerebral hemorrhage, B: cerebral infarction, the black arrows: operation and platelet transfusion).

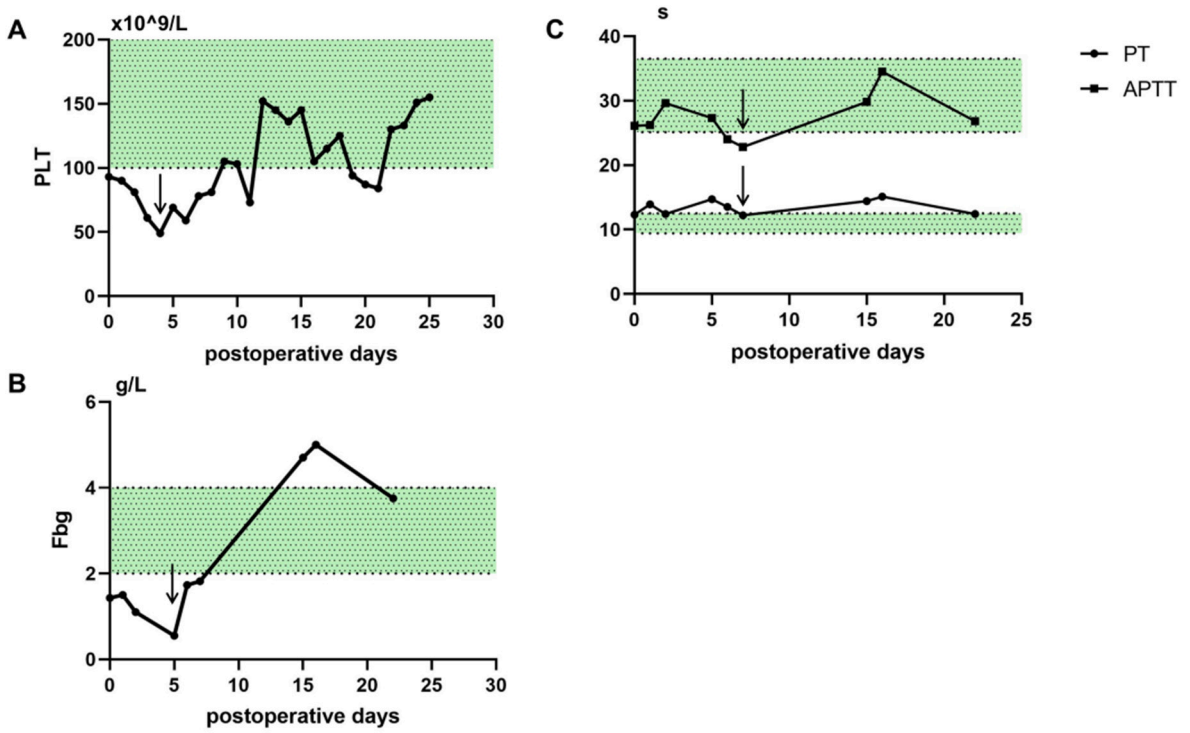

Fig. 2. Platelets declined continuously after surgery and reached a minimum value of $51*10^9$/L on the fourth postoperative day (A). Fibrinogen reached a minimum value of 0.55 g/L on the fifth postoperative day (B). Prolongation of PT occurred twice after the operation on the fifth postoperative day and the sixteenth day by 14.7 s and 15.1 s respectively (C). (The green area: normal range)

[7–9,22–26]. In this case, we presented our experience of managing these patients, that monitoring platelet function and platelet transfusion might help in perioperative management.

As described in previous similar studies, the high AA% or ADP% suggested an increased risk of preoperative hematoma expansion and postoperative bleeding [14,27,28]. In this case, we also found that both of preoperative AA% and ADP% were quite high, which suggested that the patient was under a high risk of bleeding complication. After giving platelet transfusion, the AA% and ADP% were significantly safely declined on the third day after surgery without sign of rebleeding or ischemic events; and, by continually monitoring, although the platelet count was significantly decreased on the fourth day after surgery, the platelet function recovered to the normal, which might prevent from rebleeding. Based on these facts, our experience was that it's usually not clotting dysfunction in patients on LOAPT, and a neurosurgeon should pay more attention to platelet function rather than platelet count. Sometimes, the platelet count might be acceptable, but the inhibited proportion was high; thus, the patient is still not in normal hemostasis [29]. Moreover, although there would be a massive consumption of platelet within 4 days after surgery, we thought that as long as the remaining platelet worked normally, which presented as CK-MA $>$ 40 mm and AA%/ADP% $<$60% in our experience, it could maintain the normal coagulation; however, if the platelet count was less than $50*10^9$/L, we still recommended platelet transfusion to prevent rebleeding (our experience was presented as Fig. 3).

Although there was still controversy about whether platelet transfusion should be considered for SICH patients on LOAPT [7–9,22–26], some studies have shown that platelet transfusion can improve the platelet activity [26,28]. Physiologically, it usually takes at least seven days for platelet function to recover after stopping antiplatelet therapy [30–32]. However, several studies reported that platelet transfusion could improve the platelet function in a short period [25,26,28]. We found the similar fact, that both of AA% and ADP% decreased significantly within three days after platelet transfusion and recovered to a normal level at third day after surgery. Our case also supports the

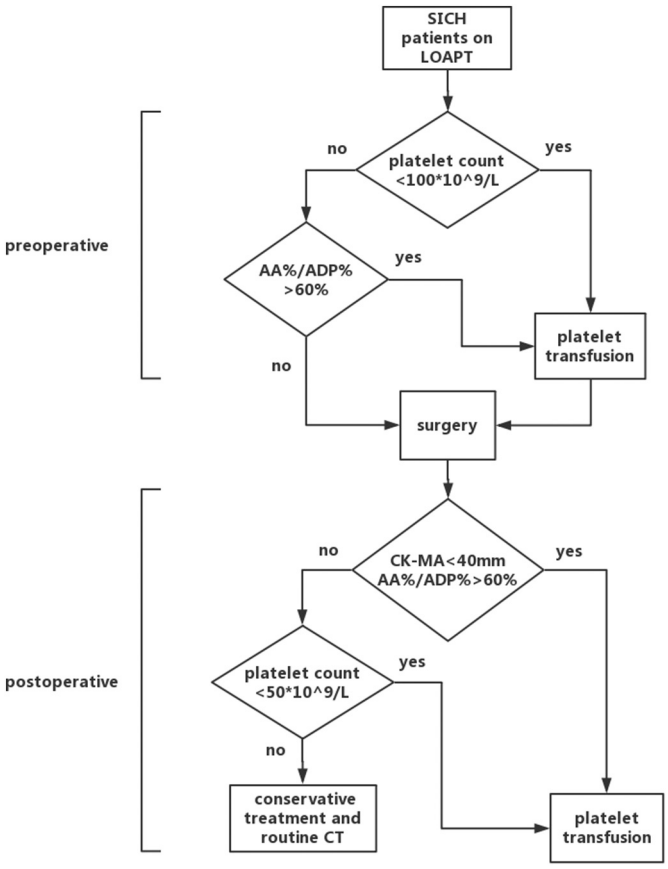

Fig. 3. The surgical decision-making flow chart of SICH patients on LOAPT.

conclusion that platelet transfusion can improve platelet function. Therefore, we believe that if the patient had a platelet dysfunction caused by LOAPT, platelet transfusion should be considered intraoperatively or within 24 h after surgery.

The effect of platelet transfusion was another concern in clinical work [7–9,27]. The PATCH study and other similar studies demonstrated that platelet transfusion not only couldn't improve the outcome, but also caused a higher mortality and rate of ischemic events [7–9]. However, considering the coagulation was more critical for operated patients, we thought that the importance of platelet transfusion is to prevent postoperative rebleeding [27]. In addition, for the patients with resistance of antiplatelet agent, non-selective platelet transfusion would increase the risk of thromboembolic events unnecessarily. Therefore, we recommended platelet transfusion for patients with significant platelet dysfunction. However, further studies were still needed to investigate the quickly and safely method to reverse the platelet function of patients on LOAPT for emergency surgery.

5. Conclusion

We report the first case that management of platelet function and coagulation function in SICH patients on LOAPT. Postoperatively, monitoring and taking control of clotting and platelet function would help in preventing rebleeding and ischemic events in such patients; moreover, platelet transfusion may quickly and safely reverse platelet dysfunction for emergency surgery.

Abbreviations

SICH	Spontaneous IntraCerebral Hemorrhage
LOAPT	Long-term Oral Antiplatelet Therapy
GCS	Glasgow Coma Scale
mRS	modified Rankin Scale
CT	Computed Tomography
CK-MA	Citric acid Kaolin-Maximum Amplitude
APTT	Activated Partial Thromboplastin Time
PT	Prothrombin Time
AA%	the inhibition rate of Arachidonic Acid
ADP%	the inhibition rate of Adenosine DiphosPhate
SSICH	Severe Spontaneous IntraCerebral Hemorrhage

Ethics approval

The work was approved by the Institutional Review Board of Tiantan Hospital, and the ethics committee number is KY2019-096-02. Written informed consents will be obtained from their legally authorized representatives. Privacy of patient has been effectively protected.

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CRediT authorship contribution statement

Author contributions to the study and manuscript preparation include the following. Conception and design: all authors. Acquisition of data: K.W. Analysis and interpretation of data: K.W and Q.L. Drafting the article: K.W. Critically revising the article: all authors. Reviewing submitted version of manuscript: all authors. Approving the final version of the manuscript on behalf of all authors: J.W. Administrative/technical/material support: S.W and J.W. Study supervision: S.W and J.W.

Guarantor

The Guarantor is Shuo Wang.

Research registration

None.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

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Declaration of competing interest

All authors certify that we have no affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

References

[1] C. Cordonnier, A. Demchuk, W. Ziai, C.S. Anderson, Intracerebral haemorrhage: current approaches to acute management, Lancet 392 (10154) (2018) 1257–1268.
[2] M.A. Hornor, T.M. Duane, A.P. Ehlers, et al., American College of Surgeons' guidelines for the perioperative management of antithrombotic medication, J. Am. Coll. Surg. 227 (5) (2018) 521–536.e521.
[3] S. Luzzi, A. Elia, M. Del Maestro, et al., Indication, timing, and surgical treatment of spontaneous intracerebral hemorrhage: systematic review and proposal of a management algorithm, World Neurosurg. (2019) e1–e10.
[4] Y.T. Lo, A.A.Q. See, N.K.K. King, Decompressive craniectomy in spontaneous intracerebral hemorrhage: a case-control study, World Neurosurg. 103 (2017) 815–820.e812.
[5] Y. Li, R. Yang, Z. Li, et al., Surgical evacuation of spontaneous supratentorial lobar intracerebral hemorrhage: comparison of safety and efficacy of stereotactic aspiration, endoscopic surgery, and craniotomy, World Neurosurg. 105 (2017) 332–340.
[6] J. Wu, Q. Liu, K. Wang, et al., Emergency surgery is an effective way to improve the outcome of severe spontaneous intracerebral hemorrhage patients on long-term oral antiplatelet therapy, Neurosurg. Rev. 44 (2020) 1205–1216.
[7] O. Eke, M. Shanechi, M. Gottlieb, Efficacy of platelet transfusion for acute intracerebral hemorrhage among patients on antiplatelet therapy, CJEM 20 (2018) S78–S81.
[8] J.L. Holzmacher, C. Reynolds, M. Patel, et al., Platelet transfusion does not improve outcomes in patients with brain injury on antiplatelet therapy, Brain Inj. 32 (3) (2018) 325–330.
[9] M. Irem Baharoglu, Charlotte Cordonnier, Rustam Al-Shahi Salman, et al., Platelet transfusion versus standard care after acute stroke due to spontaneous cerebral haemorrhage associated with antiplatelet therapy (PATCH): a randomised, open-label, phase 3 trial, Lancet 387 (10038) (2016) 2605–2613.
[10] R.A. Agha, T. Franchi, C. Sohrabi, G. Mathew, A. Kerwan, The SCARE 2020 guideline: updating consensus Surgical CAse REport (SCARE) guidelines, Int. J. Surg. 84 (2020) 226–230.
[11] G. Teasdale, B. Jennett, Assessment of coma and impaired consciousness. A practical scale, Lancet 2 (7872) (1974) 81–84.
[12] J.C. van Swieten, P.J. Koudstaal, M.C. Visser, H.J. Schouten, J. van Gijn, Interobserver agreement for the assessment of handicap in stroke patients, Stroke 19 (5) (1988) 604–607.
[13] O.K. Yildiz, E.M. Arsava, E. Akpinar, M.A. Topcuoglu, Previous antiplatelet use is associated with hematoma expansion in patients with spontaneous intracerebral hemorrhage, J. Stroke Cerebrovasc. Dis. 21 (8) (2012) 760–766.
[14] J. Kawano-Castillo, E. Ward, A. Elliott, et al., Thrombelastography detects possible coagulation disturbance in patients with intracerebral hemorrhage with hematoma enlargement, Stroke 45 (3) (2014) 683–688.
[15] P. Camps-Renom, A. Alejaldre-Monforte, R. Delgado-Mederos, et al., Does prior antiplatelet therapy influence hematoma volume and hematoma growth following

intracerebral hemorrhage? Results from a prospective study and a meta-analysis, Eur. J. Neurol. 24 (2) (2017) 302–308.
[16] J. Roquer, A. Rodríguez Campello, M. Gomis, A. Ois, V. Puente, E. Munteis, Previous antiplatelet therapy is an independent predictor of 30-day mortality after spontaneous supratentorial intracerebral hemorrhage, J. Neurol. 252 (4) (2005) 412–416.
[17] K. Toyoda, Y. Okada, K. Minematsu, et al., Antiplatelet therapy contributes to acute deterioration of intracerebral hemorrhage, Neurology 65 (7) (2005) 1000–1004.
[18] P. Saloheimo, M. Ahonen, S. Juvela, J. Pyhtinen, E.R. Savolainen, M. Hillbom, Regular aspirin-use preceding the onset of primary intracerebral hemorrhage is an independent predictor for death, Stroke 37 (1) (2006) 129–133.
[19] Romuald Seizeur, Gwenael Prat, Dominique Mottier, Emmanuel Oger, Antiplatelet drug use preceding the onset of intracerebral hemorrhage is associated with increased mortality, Fundamental & Clinical Pharmacology. 21 (2007) 327–333.
[20] B.B. Thompson, Y. Béjot, V. Caso, et al., Prior antiplatelet therapy and outcome following intracerebral hemorrhage: a systematic review, Neurology 75 (15) (2010) 1333–1342.
[21] N.I. Khan, F.M. Siddiqui, J.N. Goldstein, et al., Association between previous use of antiplatelet therapy and intracerebral hemorrhage outcomes, Stroke 48 (7) (2017) 1810–1817.
[22] C.J. Creutzfeldt, J.R. Weinstein, W.T. Longstreth, K.J. Becker, T.O. McPharlin, D. L. Tirschwell, Prior antiplatelet therapy, platelet infusion therapy, and outcome after intracerebral hemorrhage, J. Stroke Cerebrovasc. Dis. 18 (3) (2009) 221–228.
[23] G.D. Arnone, P. Kumar, M.C. Wonais, et al., Impact of platelet transfusion on intracerebral hemorrhage in patients on antiplatelet therapy-an analysis based on intracerebral hemorrhage score, World Neurosurg. 111 (2018) e895–e904.
[24] A.F. Ducruet, Z.L. Hickman, B.E. Zacharia, et al., Impact of platelet transfusion on hematoma expansion in patients receiving antiplatelet agents before intracerebral hemorrhage, Neurol. Res. 32 (7) (2010) 706–710.
[25] X. Li, Z. Sun, W. Zhao, et al., Effect of acetylsalicylic acid usage and platelet transfusion on postoperative hemorrhage and activities of daily living in patients with acute intracerebral hemorrhage, J. Neurosurg. 118 (1) (2013) 94–103.
[26] A.M. Naidech, S.M. Liebling, N.F. Rosenberg, et al., Early platelet transfusion improves platelet activity and may improve outcomes after intracerebral hemorrhage, Neurocrit. Care. 16 (1) (2012) 82–87.
[27] H. Zhou, L. Chen, H. He, Intraoperative and postoperative effects of TEG-guided platelet transfusion on antiplatelet drug-related intracerebral hemorrhage patients, Exp. Ther. Med. 17 (3) (2019) 2263–2267.
[28] C. Beynon, O.W. Sakowitz, A.W. Unterberg, Multiple electrode aggregometry in antiplatelet-related intracerebral haemorrhage, J. Clin. Neurosci. 20 (12) (2013) 1805–1806.
[29] M.M. McDonald, T.S. Almaghrabi, D.M. Saenz, et al., Dual antiplatelet therapy is associated with coagulopathy detectable by thrombelastography in acute stroke, J. Intensive Care Med. 35 (1) (2020) 68–73.
[30] Marina Weber Artur-Aron, Thomas Braun, et al., Recovery of platelet function after discontinuation of clopidogrel treatment in healthy volunteers, Br. J. Clin. Pharmacol. 52 (2001) 333–336.
[31] M.J. Price, P.S. Teirstein, Dynamics of platelet functional recovery following a clopidogrel loading dose in healthy volunteers, Am. J. Cardiol. 102 (6) (2008) 790–795.
[32] T.C. Collyer, D.J. Gray, R. Sandhu, J. Berridge, G. Lyons, Assessment of platelet inhibition secondary to clopidogrel and aspirin therapy in preoperative acute surgical patients measured by thrombelastography platelet mapping, Br. J. Anaesth. 102 (4) (2009) 492–498.