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ORIGINAL RESEARCH

Efficacy and Safety of Early Use of Naoxueshu Within 72 hours in the Treatment of Spontaneous Intracerebral Hemorrhage: A Real-World Retrospective Cohort Study

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Background: Naoxueshu Oral Liquid (NXS) is the only traditional Chinese medicine approved for the treatment of spontaneous intracerebral hemorrhage (ICH). While randomized controlled trials have demonstrated its ability to promote hematoma absorption and improve neurological function prognosis, the efficacy and safety of NXS early use (within 72 hours) remain unclear. This study aims to evaluate the efficacy and safety of early NXS administration (within 72 hours) in a real-world setting.

Methods: Data were collected from 34 tertiary hospitals in China. Patients were enrolled from March 25, 2019 to December 31, 2023. NXS administration was defined as the exposure. The primary outcome was hematoma volume at 14 days after onset. We employed the 1:1 propensity score matching (PSM) method to deal with confounding factors.

Results: A total of 1602 patients were enrolled after PSM, including 872 NXS users (exposed group) and 730 non-NXS users (control group). At baseline, there was no significant difference in hematoma volumes between the two groups (21.46±19.47 vs 22.01 ±14.26mL, P=0.55), the NXS group showed significantly less hematoma volume by day 14 (6.87±8.62 vs 5.43±5.35mL, P<0.001). There was no statistically significant difference in the incidence rate of serious adverse events between the two groups. Subgroup analysis indicated that NXS might have a more pronounced effect on hematoma absorption in supratentorial hemorrhage patients, with earlier administration potentially enhancing efficacy.

Conclusion: This retrospective study explored the efficacy and safety of NXS in promoting hematoma absorption within 72 hours in real-world ICH patients, but its effect on short-term neurological improvement remains inconclusive. Further studies with longer follow-up periods and more comprehensive functional assessments are warranted to explore the long-term neurological benefits of NXS in ICH patients.

Keywords: intracerebral hemorrhage, traditional Chinese medicine, real-world

Introduction

Intracerebral hemorrhage (ICH) is a particularly devastating form of stroke. Although it represents merely 10%–20% of all stroke cases, it accounts for approximately 44% of stroke-related mortality, underscoring its disproportionately high clinical impact.[1,2] The timely removal of the hematoma is a crucial aspect of ICH treatment. While surgical intervention has been shown to reduce mortality rates, its benefits regarding functional outcomes remain ambiguous,[3,4] minimally invasive surgery appear to be promising. Medical management continues to revolve around blood pressure management, achieving hemostasis, and hyperosmolar therapy, highlighting the necessity for novel therapies.[5]

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Naoxueshu Oral Liquid is a traditional Chinese medicine formulated based on the principle of promoting blood circulation and removing blood stasis. Previous randomized controlled trials (RCTs) have found that the application of Naoxueshu within 7 days can alleviate hematoma and improve neurological outcomes.[6–8] However, due to the strict inclusion criteria, rigorous monitoring protocols, and uniform treatment method of RCTs, these findings may not fully reflect the outcomes in the general treatment population. Meta-analysis showed that the quality of previous literature was low, the content was not comprehensive enough. On the other hand, preclinical studies have shown that Naoxueshu promotes recovery after intracerebral hemorrhage primarily by reducing inflammatory responses and decreasing blood–brain barrier permeability.[9,10] The 72-hour period marks the peak of inflammatory responses following intracerebral hemorrhage,[11,12] yet the efficacy of Naoxueshu when administered within this critical window has not been rigorously evaluated. Overall, there is a paucity of real-world data on the efficacy and safety of NXS in the treatment of ICH in the acute phase (< 72h), which are crucial for understanding how treatment performs outside the randomized controlled settings. Therefore, we conducted a retrospective analysis of electronic medical records (EMRs) from 34 large-sized hospital to evaluate the efficacy and safety of NXS in ICH patients.

Methods

Data Collection

In this study, we retrospectively collected data of 1602 sICH patients from March 25, 2019, to December 31, 2023. The inclusion criteria were as follows:

(1) diagnosis of spontaneous intracerebral hemorrhage, confirmed first (or recurrent) stroke by computerized tomography (CT)
(2) within 72 hours from the onset
(3) aged 18 years or older

The exclusion criteria were:

(1) Secondary ICH, caused by trauma, brain tumor, coagulopathy, cerebral infarction, ruptured aneurysm, vascular malformation, venous sinus thrombosis, or other known causes;
(2) ICH concomitant with subarachnoid hemorrhage or intraventricular hemorrhage
(3) preexisting neurological deficit (mRS score >1) or psychiatric disease that would confound the neurological or functional evaluations;
(4) Incomplete or missing basic data or follow-up

This real-world, retrospective cohort study was conducted at 34 tertiary hospitals in China, from March 25, 2019 to December 31, 2023. Data were extracted from electronic medical records (EMRs), which are routinely updated and subjected to quality control measures at each participating hospital. To ensure data accuracy, two independent reviewers performed data extraction, and any discrepancies were resolved by a third researcher.

Data confidentiality was strictly maintained by anonymizing and de-identifying all patient information before analysis. This study was approved by the Ethics Committee of the Xuanwu Hospital, Capital Medical University. Ethical approval was obtained from each participating hospital's institutional review board, and informed consent was waived due to the retrospective nature of the study. It was performed according to the Principles of Declaration of Helsinki.

Outcome

The primary outcome, hematoma volume, was calculated using the ABC/2 method, a well-established formula for estimating hemorrhage volume from CT images. The formula is: length × width × number of slices / 2 (in cm, slice thickness: 5 mm). Measurements were performed by two independent radiologists to minimize inter-observer variability. Secondary outcomes included the NIHSS score at 14 days after onset (or at discharge) and the severity of brain edema at

14 days after onset (or at discharge). Brain edema categorized into four grades: (1) no brain edema; (2) formation of an edema zone around the hematoma; (3) grade 2 combined with compression of the ventricular system; (4) midline shift in addition to the manifestations of grades 2 and 3.

Safety indicators included routine blood tests, liver and kidney function, and in-hospital mortality, and the proportion of deep vein thrombosis and pulmonary infection.

Statistical Analysis

The continuous variables were expressed as the mean ± standard deviation, and the categorical variables were presented as counts and percentages (%). For normally distributed variables, differences between groups were analyzed using Student's *t*-test, and for non-normally distributed variables, the Wilcoxon rank sum test was used. For comparison of categorical variables, the chi-squared test was used.

To eliminate the influence of baseline covariates, we employed the PSM method to deal with potential confounding factors. Literature search was used to select the confounders with relatively large impact on the results. The following confounding factors were included in the PSM model: age, baseline NIHSS, hematoma volume, hematoma location, and surgery or not. The MatchIt package of R software was employed to carry out the propensity score matching method. And we conducted the PSM using the 1:1 nearest neighbor matching, with a caliper of 0.2 on a logit scale. The balance between covariates before and after matching was assessed using the standardized mean difference (SMD), and an SMD threshold of 0.1 was considered substantial imbalance.

SPSS 22.0 and R 3.6.2 software were employed for statistical analysis with $P<0.05$ defined as statistical significance.

Result

Baseline Characteristics of Study Patients

A total of 1602 patients were enrolled in the final cohort, with 872 (54.4%) patients in the exposed group and 730 (45.5%) patients in the control group (Table 1). Before PSM, NXS users were older (59.10 ±14.52 vs 60.77 ±14.82) and had higher NIHSS (17.06 ± 17.53 vs 15.33± 10.15). Considering the interference of confounding factors, the PSM method was employed to balance the baseline covariates.[13] The use of propensity score matching properly eliminated the differences in baseline features among exposed group and control group in age, NIHSS, hematoma location, and hematoma volume. After PS matching, no significant differences in baseline characteristics were observed between the two groups (Table 1).

Table 1 The Baseline Characteristic Before and After Propensity Score Matching

	Before PSM				After PSM			
	Exposed Group (730)	Control Group (872)	P Value	Std. Mean Diff.	Exposed Group (677)	Control Group (677)	P Value	Std. Mean Diff.
Demographic								
Age, mean (SD), y	59.10 (14.52)	60.77 (14.82)	0.024*	0.113	60.16 (13.54)	60.13 (14.87)	0.963	0.002
Male (%)	465 (65.6)	556 (63.8)	0.483	0.038	440 (65.7)	433 (62.8)	0.303	0.059
Smoker (%)	147 (24.0)	142 (16.3)	0.225	0.081	103 (17.8)	98 (16.9)	0.382	0.055
Alcohol drinker (%)	263 (37.2)	258 (36.6)	0.321	0.058	252 (37.2)	248 (36.6)	0.231	0.069
Medical history (%)								
Hypertension	546(77.7)	649 (76.6)	0.674	0.025	518 (78.1)	501 (74.9)	0.183	0.077
Diabetes mellitus	110 (18.0)	142 (16.3)	0.203	0.194	107 (18.9)	103 (14.9)	0.382	0.25
Admission status, mean(SD)								
NIHSS	15.33 (10.15)	17.06 (8.68)	<0.001*	0.183	15.99 (9.95)	16.26 (8.66)	0.591	0.029
GCS score	11.24 (3.73)	11.04 (2.86)	0.230	0.061	11.06 (3.74)	11.28 (2.78)	0.226	0.067
Systolic BP, mmHg	152.56 (24.09)	151.05 (20.03)	0.171	0.068	152.03 (23.64)	151.50 (19.73)	0.654	0.024
Diastolic BP, mmHg	90.88 (27.43)	91.53 (9.85)	0.523	0.032	90.69 (27.88)	91.45 (9.92)	0.512	0.036

(*Continued*)

Table 1 (Continued).

	Before PSM				After PSM			
	Exposed Group (730)	Control Group (872)	P Value	Std. Mean Diff.	Exposed Group (677)	Control Group (677)	P Value	Std. Mean Diff.
Initial imaging, mean(SD)								
Hematoma volume, mL	21.03 (19.35)	22.61 (14.22)	0.061	0.093	21.46 (19.47)	22.01 (14.26)	0.548	0.032
Edema degree	2.48 (0.85)	2.49 (0.88)	0.77		2.50(0.85)	2.49 (0.89)	0.890	
Location (%)								
Lobar	210 (28.8)	247 (28.3)	0.524	0.101	199 (28.9)	193 (28.0)	0.996	0.023
Deep	374 (51.2)	476 (54.6)			362 (52.5)	367 (53.3)		
Cerebellar	58 (7.90)	54 (6.20)			47 (6.80)	49 (7.10)		
Brain stem	65 (8.90)	71 (8.10)			61 (8.90)	60 (8.70)		
Laboratory testing (mean ± SD)								
WBC, 10^9/L	10.85 (16.21)	10.96 (5.22)	0.865	0.009	11.05 (16.66)	10.92 (5.50)	0.855	0.011
HGB, g/L	137.78 (23.9)	133.16 (73.0)	0.105	0.069	139.2 (24.6)	132.99 (24.3)	0.115	0.075
PLT, 10^9/L	212.17 (75.68)	212.19 (60.64)	0.996	<0.001	210.67 (75.81)	211.61 (60.01)	0.817	0.014
APTT, s	44.04 (29.95)	44.80 (40.05)	0.703	0.022	44.39 (30.38)	41.72 (35.40)	0.184	0.081
PT, s	13.60 (2.67)	13.85 (3.84)	0.193	0.074	13.64 (2.72)	13.77 (3.78)	0.518	0.039
TT, s	16.41 (5.08)	16.13 (9.88)	0.527	0.036	16.41 (5.20)	16.25 (10.96)	0.755	0.018
FIB, g/l	3.98 (1.71)	3.64 (4.37)	0.069	0.093	4.00 (1.73)	3.65 (4.69)	0.090	0.092
Abnormal liver function, n (%)	10 (1.7)	10 (1.5)	0.976	0.015	10 (1.7)	8(1.6)	0.906	0.041
Abnormal kidney function, n (%)	17 (3.8)	23 (3.2)	0.380	0.055	15 (2.7)	21 (4.1)	0.290	0.075

Note: *significant at 0.05.
Abbreviations: SD, standard deviation; Std. MeanDiff., Standard Mean Difference; Systolic BP, systolic blood pressure; Diastolic BP, diastolic blood pressure; NIHSS, National Institutes of Health Stroke Scale; GCS, Glasgow Coma Scale; mRS, modified Rankin Scale; WBC, white blood cell; PT, prothrombin time; APTT, activated partial thromboplastin time; FIB, fibrinogen;

Primary Outcome

The NXS group had significantly decreased hematoma volume than the control group (Table 2) after 14 days. The mean baseline hematoma volume is 21.46 ± 19.47mL in NXS group and 22.01 ± 14.26 mL in the control group, with no statistical difference between the two groups (P=0.55). After NXS administration, the exposed group hematoma volume was significantly less than that of the control group (6.87 ± 8.62 vs 5.43 ± 5.35 mL, P value< 0.001). The hematoma volume changes from baseline to the 14 day were significantly different in the exposed group compared to the control group (16.77 ± 13.01 vs 14.14 ± 16.96 mL, P< 0.01). Meanwhile, the degree of brain edema in the NXS group was found to be significantly decreased than the control group after NXS administration after 14 days (P < 0.001), while no significant difference in NIHSS scores was observed between the patients in two groups (P=0.116). Comparison of hematoma volume and NIHSS score at baseline and after treatment is shown in Figures 1 and 2.

Table 2 Comparison of the Efficacy Indices at 14 Day Between Two Groups

	Before PSM				After PSM			
	Control Group (730)	Exposed Group (872)	P Value	Std. Mean Diff.	Control Group (677)	Exposed Group (677)	P Value	Std. Mean Diff.
14-day hematoma volume (mL)	6.79 (8.57)	5.69 (5.49)	0.003*	0.153	6.87 (8.62)	5.43 (5.35)	<0.001*	0.2
Change of hematoma volume (mL)	13.61 (16.48)	16.84 (12.83)	<0.001*	0.231	14.14 (16.96)	16.77(13.01)	0.003*	0.181
14-day NIHSS score	11.77 (8.76)	11.70 (7.32)	0.871	0.009	12.22 (8.69)	11.60 (7.27)	0.116	0.076
14-day cerebral edema score	1.98(1.0)	1.78 (0.77)	<0.001*	0.227	1.97 (1.03)	1.76 (0.79)	<0.001*	0.340

Note: *significant at 0.05.
Abbreviations: NIHSS, National Institutes of Health Stroke Scale; GCS, Glasgow Coma Scale.

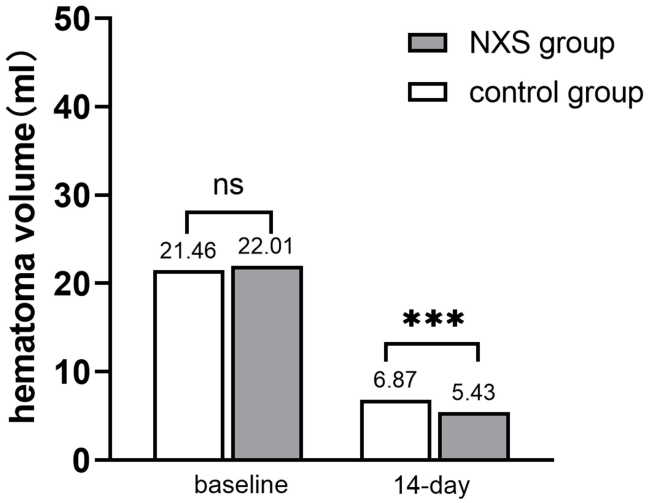

Figure 1 Hematoma volume at baseline and 14 days after treatment; After 14 days of treatment with Naoxueshu, the volume of hematoma in the treatment group was significantly lower than that in the control group (P<0.001).
Notes: ***P<0.001; NXS group: (regular treatment plus Naoxueshu oral liquid group); Control group (regular treatment group).
Abbreviations: ns, no statistically significant.

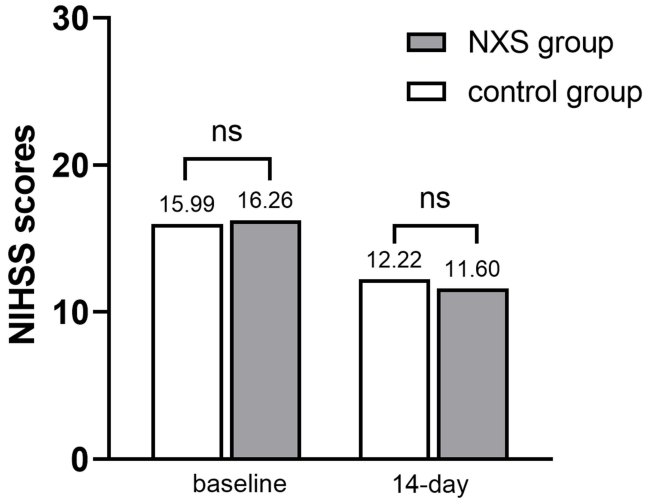

Figure 2 NIHSS score at baseline and 14 days after treatment; There was no significant difference in NIHSS score between naoxueshu group and control group after 14 days of Naoxueshu treatment (P>0.05).
Notes: XS group: (regular treatment plus Naoxueshu oral liquid group); Control group (regular treatment group).
Abbreviations: ns, no statistically significant.

Safety Outcome

There were no between-group differences in terms of the safety outcomes, NXS did not cause any abnormality of safety indicators including blood routine, coagulation function, liver and kidney function (Table 3). The proportions of mortality were 3.29% in the control group and 3.23% in the NXS group, and no significant difference was detected (P=0.22). There was no statistically significant difference between the two groups in the incidence rate of the deep vein thrombosis and pulmonary infection.

Subgroup Analysis

In subgroups with different NXS administration times (within 24, 48, or 72 hours of onset), the reduction of hematoma volume in NXS group was greater than that in WM group (P<0.001, P=0.003, P=0.031, respectively). The hematoma

Table 3 Comparison of the Safety Indices at 14 Day Between Two Groups

	Before PSM			After PSM		
	Control Group (730)	**Exposed Group (872)**	**P Value**	**Control Group (677)**	**Exposed Group (677)**	**P Value**
Serious adverse events						
Mortality, n (%)	21 (3.24)	18 (3.36)	0.121	18 (3.29)	16 (3.23)	0.223
Deep vein thrombosis, n (%)	87 (9.9)	71(9.8)	0.971	70 (11.8)	66(10.3)	0.795
Pulmonary infection, n (%)	218 (25.1)	167 (23.0)	0.703	176 (26.2)	165 (24.5)	0.652
Abnormal liver function, n (%)	17 (3.8)	13 (2.1)	0.056	13 (3)	10 (2)	0.069
Abnormal kidney function, n (%)	17 (3.8)	25 (3.9)	0.987	17 (3.9)	19 (3.8)	0.990
WBC, 10^9/L	10.43(9.2)	9.62(3.9)	0.077	10.52(9.47)	9.57(4.03)	0.051
HGB, g/L	133.06(27.9)	136.16(38.7)	0.190	133.24(24.6)	136.23(24.3)	0.263
PLT, 10^9/L	226.23(70.7)	218.50(69.5)	0.083	223.48 (73.31)	217.36 (67.63)	0.072
APTT, s	30.74 (19.32)	32.20 (17.93)	0.313	30.97 (10.34)	32.42 (21.17)	0.242
PT, s	13.49 (2.15)	13.96 (7.07)	0.245	13.49 (2.41)	14.26 (8.22)	0.099
TT, s	15.90 (2.33)	16.10 (4.37)	0.472	15.89 (2.53)	16.05 (4.19)	0.518
FIB, g/l	5.75 (19.49)	6.00 (25.82)	0.881	5.66(19.19)	6.27 (28.56)	0.730

Abbreviations: WBC, white blood cell; PT, prothrombin time; APTT, activated partial thromboplastin time; FIB, fibrinogen; ALT, alanine aminotransferase; WBC, white blood cell; PT, prothrombin time; APTT, activated partial thromboplastin time; FIB, fibrinogen; ALT, alanine aminotransferase.

volume reduction in patients treated with NXS within 24, 48, and 72 hours was 16.76±18.94, 15.05±7.68, and 13.67 ±11.83, respectively. Early drug application may be associated with more hematoma absorption. As to location, in the subgroups of patients with infratentorial hemorrhage, the hematoma volume reduction from day 1 to day 15 was not statistically significant between the NXS and control groups (P=0.167, Table 4).

Table 4 Hematoma Volume Changes Among Subgroups of Different Ages, Hemorrhage Volume, Haematoma Location and Administration Time

	Before PSM			After PSM		
	Exposed Group (n=730)	**Control Group (n=872)**	**P Value**	**Exposed Group (677)**	**Control Group (677)**	**P Value**
Age						
Age≧60	16.41±13.45	11.18±15.56	<0.001*	16.12±13.24	11.56±15.37	<0.001*
Age<60	16.65±12.44	13.02±13.10	<0.001*	16.45±12.23	12.87±13.45	<0.001*
Hemorrhage volume						
≥15mL	19.17±16.72	18.07±14.47	0.011*	18.97±16.45	17.89±14.76	0.013*
<15mL	11.79±6.52	7.22±8.75	<0.001*	11.98±6.75	7.54±8.97	<0.001*
Haematoma location						
Cortical lobe	15.96±14.95	17.41±11.72	0.021*	14.98±14.76	17.02±11.95	0.028*
Deep	12.31±14.22	16.42±12.93	<0.001*	12.67±14.05	15.13±13.02	<0.001*
Infratentorial	8.75±10.54	10.91±7.08	0.141	8.97±10.34	10.78±7.21	0.167
Time of administration						
≦24h	17.97±19.09	12.11±15.88	<0.001*	16.76±18.94	12.45±16.07	<0.001*
≦48h	15.23±7.89	12.11±15.88	0.002*	15.05±7.68	12.45±16.07	0.003*
≦72h	14.89±11.64	12.11±15.88	0.026*	13.67±11.83	12.45±16.07	0.031*

Note: *significant at 0.05.
Abbreviation: PSM, Propensity Score Matching.

Discussion

In this study, we found that the administration of Naoxueshu within 72 hours can accelerate the absorption of intracerebral hemorrhage hematoma, resulting in a smaller hematoma volume in the expose group compared to the control group after 14 days. However, we did not find real-world evidence to support our hypothesis that early NXS treatment improves neurological function outcome in ICH patients compared with conventional treatment. Furthermore, the effect in main outcomes was observed in almost all patient subgroups, except subtentorial subgroup.

It has been widely reported that NXS could promote hematoma absorption in ICH patients in randomized, controlled trials.[8] However, the benefits and safety of early use of NXS within 72 hours remain unclear at present. We found that the application of NXS within 72 hours effectively decreased hematoma lesions and relieve the brain edema in ICH patient, which was comparable to the that used within 7 days in previous studies.[8] Hematoma volume is the major determinant of outcomes of intracerebral hemorrhage,[5] interplay with these other prognostic factors, thereby influencing outcome and prognosis and becoming an important way of intervention[13,14] By reducing hematoma volume, NXS may indirectly contribute to improved long-term outcomes, such as enhanced neurological recovery and reduced disability. Regarding brain edema, which is associated with poor prognosis in patients with ICH,[15,16] we also observed reduction in the degree of edema than those receiving only western medicine, which is consistent with previous studies.

It should be pointed out that, after two weeks of treatment, we did not observe more significant neurological recovery in the NXS group compared to the control group. Nevertheless, previous randomized controlled trials have shown better neurological outcomes in the NXS group after 21 days.[8] The lack of observed neurological improvement within two weeks may be attributed to the relatively short follow-up period. Neurological recovery in ICH patients is often a gradual process, and two weeks may be insufficient to detect significant functional changes.[17,18] Considering the previous pharmacological findings, which naoxueshu alleviated the secondary injury through inflammatory response and oxidative stress, a longer follow-up period might be necessary to observe the potential benefits of NXS on neurological recovery.

In addition, this study did not observe statistically significant differences between the two groups in terms of abnormalities in blood routine, coagulation, or liver and kidney function. There were also no significant differences in the rate of mortality and the proportions of complications, demonstrating the safety of early use of NXS.

Although subgroup analysis indicates the reduction on hematoma volume was not significant in infratentorial group, these findings are not conclusive due to the small numbers of patients and the less volume of hematoma in the infratentorial subgroup. Future treatment strategies could consider tailoring interventions based on hemorrhage location. As to different administration time subgroups, earlier use of NXS was associated with greater hematoma volume reduction after two weeks, which is consistent with preclinical studies.[19,20] In preclinical studies, drug administration at different time points can promote the absorption of the hematoma, and the administration of drugs within 6 hours after acute intracerebral hemorrhage produces the best effect. Further clinical studies are expected to determine the optimal location and timing of administration in practice.

The damage caused by cerebral hemorrhage involves primary injury from the mass effect and physical disruption of the haematoma and secondary injury driven by factors such as oxidative stress, inflammatory response, and ferroptosis. Naoxueshu oral liquid (NXS) is a TCM patent drug, based on the theory of activating blood and removing stasis, whose main ingredients consist of Astragalus membranaceus Bunge, Paeonia × suffruticosa Andrews, Hirudo nipponica Whitman, Achyranthes bidentata Blume, Rheum palmatum L., Acorus calamus L., and Ligusticum chuanxiong Hort. The primary components of Naoxueshu oral liquid are Astragalus membranaceus and Hirudo nipponica Whitman. Astragaloside IV in Radix Astragali (Huangqi)[21,22] exhibits anti-inflammatory, anti-oxidative stress, and prevent cerebral ischemia. Hirudin,[23,24] a natural specific inhibitor of thrombin can, inhibit neuroinflammation. The mechanism of how NXS contributes to the absorption of hematoma remains elusive. Previous studies suggest that NXS promotes hematoma absorption by regulating microglial activation via the TLR4/MyD88/NF-κB and Nrf2/CD163/HO-1 pathways[9,10] These mechanisms align with our findings, as microglial activation plays a critical role in neuroinflammation and hematoma clearance. In conclusion, the pharmacological effects of NXS are supported by its anti-inflammatory, anti-oxidative, and immune-modulating properties.

Currently, while surgical evacuation may provide rapid hematoma reduction, it carries inherent risks and is not suitable for all patients.[25,26] NXS, on the other hand, may serve as a complementary or alternative option, particularly in cases where surgery is contraindicated. Treatments like prothrombin complex concentrates and hemostatic agents focus primarily on controlling bleeding.[27,28] In contrast, NXS offers a more comprehensive approach by addressing inflammation and microglial activation, which could enhance recovery beyond mere hematoma clearance. NXS is relatively inexpensive compared to surgical interventions and other pharmacological treatments, making it a viable option for widespread use. However, its accessibility may be limited by regional variations in the availability of traditional Chinese medicines. Future studies should evaluate the cost-effectiveness of NXS in different healthcare systems and explore strategies to improve its accessibility, such as integrating it into standardized treatment protocols for ICH.

There are still some limitations in our current study. Firstly, as a retrospective study, although many important confounders were accounted for, residual unknown or unmeasured confounding factors cannot be eliminated. Secondly, while all participating hospitals followed national guidelines for the diagnosis and management of ICH, there are differences in levels and preferences between hospitals, this may have resulted in potential variability. Third, since most subjects were Asian, the generalizability of these results for other ethnicities may be concerned. Then, adverse events were not clearly identified and analyzed due to limitations in medical records and data collection.

Conclusion

Collectively, the results of this study suggested that Naoxueshu is safe and can promote hematoma absorption in patients with ICH presenting within 72 hours after symptom onset. Our study provides real-world evidence to fill the current knowledge gap regarding the use of NXS in wider population. Further researches with long follow-up are needed to explore the benefit of neurological outcome and the optimal treatment timing.

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Disclosure

The authors report no conflicts of interest in this work.

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