

Chronic Subdural Hematoma in Elderly Patients: Is This Disease Benign?

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Abstract

As the world population becomes progressively older, the overall incidence of chronic subdural hematoma (CSDH) is increasing. Peak age of onset for CSDH has also increased, and recently the 80-year-old level has a peak. Many patients with CSDH have had prior treatment with anticoagulants and anti-platelet drugs, which have an accompanying risk of CSDH. In elderly patients with CSDH, symptoms of cognitive change (memory disturbance, urinary incontinence, and decreased activity) and disturbance of consciousness at admission were more frequent compared to younger patients with CSDH. The literature actually offers conflicting advice regarding CSDH treatment; however, burr hole surgery with drainage under local anesthesia is the most common surgical procedure, even in elderly patients. The recurrence rate of CSDH has not decreased over recent decades, and it has ranged from 0.36–33.3%. Outcomes in patients over 75 years old was significantly worse than for those younger than 75. Moreover, long-term outcomes for elderly patients with CSDH are poor. CSDH in the elderly is no longer a benign disease. In the future, it will be important for us to understand the mechanisms of onset and recurrence of CSDH and to develop more effective medical treatments and noninvasive surgical techniques for elderly patients.

Key words: chronic subdural hematoma, epidemiology, treatment, recurrence rate, long-term outcome

Introduction

Chronic subdural hematoma (CSDH) is the most common neurosurgical disease, and it affects mainly elderly patients. As the world population becomes progressively older, the overall incidence is increasing. Moreover, Japan is one of the fastest aging countries in which people older than 65 years comprised 26.8% of the overall population in 2015, and they are expected to increase to 40% in 2060. Therefore, the number of elderly patients with CSDH will explosively increase in Japan and all over the world.

There are many papers about CSDH; however, papers focusing on CSDH in elderly patients are rare. The aim of this review is to analyze the recent literature about CSDH in elderly patients and to discuss the epidemiology, symptoms, treatment, and short- and long-term outcomes. Although it is difficult to make the definition of elderly patients in the review article, we mainly review the papers among the patients older than 65 years old.

Epidemiology

According to the Helsinki study from Foelholm et al. in 1975, the incidence of CSDH was 1.7/100,000/year

in the general population.¹⁾ However, recently, the incidence has been increasing. In 1992, Kudo et al. reported the incidence in the local area of Awagishima, Japan was 13.1/100,000/year,²⁾ and Karibe et al. reported in 2011 incidence in the Miyagi prefecture in Japan was 20.6/100,000/year.³⁾ The incidence of CSDH increases with age.³⁾ In North Wales, the incidence in people over 65 years old was 8.2/100,000/year.⁴⁾ Kudo et al. reported the incidence in those over 65, was 58.1/100,000/year,²⁾ and Karibe et al. reported it was 80.1/100,000/year in people over 65 years of age and was 127.1/100,000/year in those over 80 years of age in 2011.³⁾

Peak age of onset of CSDH has also increased. In the 1970s, the age of onset was most commonly 50 years old,⁵⁾ in the 1980s, it was 60 years old,⁶⁾ and from 1990 to 2010, it was more common to have an age of onset of 70 years. More recently, the peak age of onset was shown to be 80 years old according to data from a Japanese national administrative database (Fig. 1).⁷⁾

These days, the sex ratio of CSDH has also changed. Elderly women are increasingly being diagnosed⁷⁾. In the 1970s, the ratio of women with CSDH was only 9%, and in the 1980s, it was 22.4%. Moreover, in the 2010s, it was 31.6%. Thus, male preponderance diminishes with age.^{7,8)}

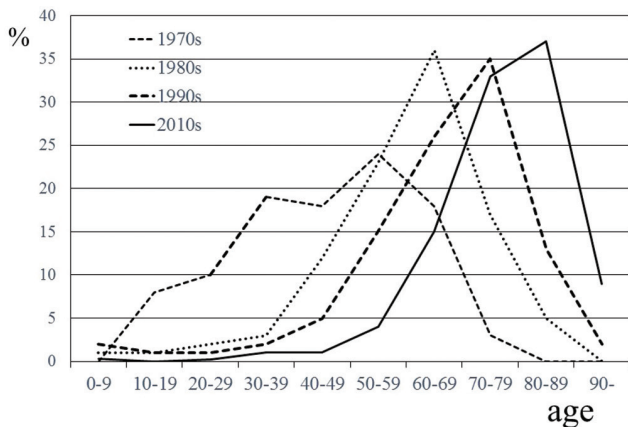


Fig. 1 Chronological change in age distribution of chronic subdural hematoma. Previous studies have reported the etiology of chronic subdural hematoma (CSDH) in Japan. In 1970s, 1980s, and 1990s, most patients with CSDH were in their 50s (---), in their 60s (.....), and in their 70s (---) respectively. One most recent study showed that most patients with CSDH were in their 80s (—).

We expect that the incidence of CSDH in 2016 in Japan, according to the Karibe's incidence ratio,³⁾ will be 26,146/year in the entire Japanese population and 13,066/year in those over 80 years old.⁹⁾ In the future, the incidence will very likely increase, especially in elderly women.

Traumatic Associated with CSDH

In elderly CSDH patients, a history of trauma is less frequent than in younger CSDH patients. The cause of trauma was fallen in elderly patients and traffic accident was less than younger patients^{3,8)}. With increasing age, brain weight declines, which leads to an increase in extracerebral volume. Thus, an arachnoid tear might easily appear after mild head trauma in elderly patients, and subdural hygromas develop into CSDH in about one-quarter of them¹⁰⁾.

Risk Factors in Elderly Patients with CSDHs

Anticoagulants and antiplatelet drugs

Many patients with CSDH had prior treatment with anticoagulants and antiplatelet drugs. The rate of patients treated with antiplatelet drugs was between 4.5% and 44%, and that of anticoagulants was between 2.5% and 40.6%^{4,8,11-19)}. In Austria, 41% of patients had either anticoagulant or antithrombotic drug treatment, and elderly patients (over 65 year old) were significantly more likely to have taken anticoagulant or antithrombotic therapy⁸⁾. In Germany, 50.3% of patients had anticoagulant therapy, and

the ratio of this treatment was increasing with increasing age¹²⁾. On the other hand, treatment of antithrombotic therapy was only 12.2% in Spain²⁰⁾ and 4.5% of antiplatelet and 2.8% of anticoagulants (2.6% warfarin and 0.2% non-vitamin K antagonist oral anticoagulants [NOACs]) in Japan⁷⁾. There are some differences in each country.

There have been many reports that treatment with antithrombotic drugs increases the incidence of CSDH^{11,13,21)}. Patients treated with warfarin had 42.5-fold increase in incidence of CSDH¹³⁾. Vitamin K usually provides a gradual normalization of the international normalized ratio, and fresh frozen plasma (FFP), prothrombin complex concentrate (PCC), or recombinant factor VIIa can provide more rapid normalization. However, FFP can promote fluid overload in elderly patients, and it is necessary to use it carefully.²²⁾

There are no evidence-based reports or guidelines about the treatment for CSDH patients with NOACs. FFP, PCC, and recombinant factor VIIa should be considered as possibly treatment options, and reversal with PRADAXA (dabigatran etexilate) (Boehringer Ingelheim Pharmaceuticals, Inc., Ridgefield, CT, USA) is also helpful. However, most elderly patients can wait for surgery for approximately 12 hours after admission; then surgery can be performed after the half-life of the NOAC has passed.

Hemodialysis

It is well known that SDH (there was no definition of acute or chronic in these papers) is an important risk for patients on long-term hemodialysis²³⁾. Forty years ago, the incidence of SDH was 3.3% in dialysis patients²⁴⁾. However, the incidence of SDH in them has increased to 188.6-191/100,000 dialysis patients/year^{23,25)}, and has double compared to 10 years ago²⁵⁾. This rate is 10 times that of the general population, and mortality rate in dialysis patients experiencing SDH is 39%²⁵⁾. It seems that volume-overloaded long-term dialysis patients may have venous hypertension, and if the patient's coagulation status is abnormal, then small venous tears of the dural bridging veins may easily expand and cause SDH²⁵⁾. Moreover, dialysis patients are older and have complex comorbidities and are more often disabled. They also fall more easily, which may cause SDH. Cook et al. showed that the incidence of falls in hemodialysis patients who were over 65 years of age was about 1.6 falls/patients-year and fall-related morbidity was high²⁶⁾.

Symptoms of CSDH in Elderly Patients

Elderly patients over 80 years of age who experienced CSDH without a history of head trauma

were more frequently seen than younger patients²⁷. In elderly patients with CSDH, symptoms associated with cognitive change (memory disturbance, urinary incontinence, and decreased activity) and disturbance of consciousness at admission were more frequent compared to younger patients who commonly presented without a disturbance of consciousness^{3,4,20,27}. These symptoms were more often seen in patients over 80 years of age^{3,7}. However, elderly patients with CSDH do not typically present in a comatose state^{16,18}.

Bilateral CSDH was seen in 9.7–34.8% of the patients studied^{8,15,19,20,28–30}. Bilateral CSDH tends to occur more commonly in elderly patients^{8,28,29}. These patients had symptoms associated with increased intracranial pressure such as headache, vomiting, and rapid disturbance of consciousness^{28,29}. Agawa et al. reported that bilateral hematoma was a risk factor for poor outcomes²⁸; however, Leroy et al. reported that there was no significant difference with regard to outcomes between bilateral and unilateral cases¹⁵. Huang et al. cautioned that diagnosis of bilateral CSDH could be delayed by lack of brain shift symptoms.³⁰

In some patients with disturbance of consciousness, acute subdural hematoma may overlap with CSDH. In these patients, computed tomography (CT) shows a fresh hematoma within the CSDH, and the fresh hematoma has both a higher and of relatively more uniform density in comparison to the surrounding CSDH. This condition is termed acute-on-chronic SDH, a type of SDH with unique characteristics^{31–33}. Patients with acute-on-chronic SDH have more hemostatic complications and more unfavorable outcomes.

Treatment

The literature actually offers conflicting advice regarding CSDH treatment, and these lead to considerable variation in actual clinical prospect. In Japan, most symptomatic patients underwent surgical treatment, and conservative treatment was rare^{3,7}. However, in the US and UK, the rate of conservative treatment of CSDH in elderly patients was higher^{4,18,19}. Even though watchful waiting has been the usual course of action in elderly patients with mild symptoms or in asymptomatic patients, there are no evidence-based guidelines about the treatment or the waiting period or about the frequency of serial CT imaging²¹. Kageyama et al. reported that tranexamic acid could treat CSDH patients without surgery³⁴ and Muramatu et al. and Miyagami and Kagawa reported Chinese Gore-San was a useful option in the conservative treatment of elderly CSDH patients^{35–37}. In the future, medical treatment for

CSDH in elderly patients will increase. Thotakura and Marabathina reported that factors related to successful conservative treatment were female sex, less midline shift, lesser hematoma thickness, and lesser attenuation values on CT imaging³⁷.

There have been no evidence-based reports or guidelines about the timing of surgery in the treatment of CSDH in elderly patients; however, it is better to operate as soon as possible after a neurological deficit appears to increase the likelihood of good operative outcomes³⁸.

Burr hole surgery (BHS) with drainage under local anesthesia is the most common surgical procedure, even in elderly patients^{16,39–41}. Weigel et al. reported that twist-drill craniotomy (TDC), BHS, and open craniotomy have approximately the same mortality rate (2–4%); open craniotomy has significantly higher morbidity, and TDC has a higher rate of recurrence, suggesting that BHS is the preferred technique^{39,40} (Table 1). However, a recent systematic review about the recurrence rate of BHS and TDC showed no significant differences; therefore, in the future, a minimally invasive and cost saving approach like TDC would be favored for elderly patients^{39,42,43}.

The duration of drainage after BHS is usually within 48 hours after operation^{16,44}, and there are no reports about BHS with or without a drain in relationship to duration in elderly CSDH patients. Few studies have compared results for CSDH between BHS drainage alone and BHS drainage with irrigation. In previous reports, the application of intraoperative irrigation during BHC is associated with fewer recurrences than without (2.9% vs. 10.3%, respectively) and is also associated with better outcomes^{44,45}.

Table 1 Average of mortality, morbidity, cure rate, and recurrence rate for the three surgical methods for treatment of chronic subdural hematoma. We modified the original figure from Weigel et al. in 2003 to fit this table

	TDC	BHC	Craniotomy
Mortality	2.9% (0–7.9%)	2.7% (0–32%)	4.6% (0–11%)
Morbidity	3.0% (0–7.6%)	3.8% (0–9%)	12.3%* (0–25%)
Cure rate	88.2% (77–100%)	79.1% (52–98%)	67.8% (40–94%)
Recurrence	33.0%* (3–76%)	12.1% (0–28.8%)	10.8% (0–44%)

TDC: twist-drill craniotomy, BHC: burr hole surgery craniotomy; open craniotomy, Data adapted from Weigel R et al: J Neurol Neurosurg Psychiatry 74: 937–943, 2003.

There is also contradictory advice about the relative risk of bed rest and rehabilitation^{38,46,47}. A recent prospective study demonstrated that recurrence rates after BHC were independent of patients' head position⁴⁶, and in another report, patients with a few days of bed rest after BHC demonstrated a significantly lower recurrence rate. If early elevation of the head and mobilization after CSDH operation in elderly patients does not impact the recurrence rate, early elevation of the head and mobilization should be employed to help prevent pneumonia and deep vein thrombosis.

Recurrence Rate of CSDH

The recurrence rate of CSDH has not decreased in recent decades, and it has ranged from 0.36 to 33.3%^{7,8,12,15,16,18,20,30,47-49}; however, most studies have shown that the recurrence rate was around 10–15%^{7,8,15,16,30,50,51}. In general, the definition of recurrence used by most authors is that of postoperative symptomatic re-collection of hematoma that requires reoperation of any kind. Elderly patients with CSDH had a higher recurrence rate compared to younger patients^{15,20}. Ooba et al. reported that there was no significant difference with regard to the recurrence rate between patients over 80 years old and those younger than 80 years of age²⁷. On the other hand, Borger et al. demonstrated that the recurrence rate in patients over 85 years of age was lower than that of those under 85 years of age¹². Goto et al. reported that the overall recurrence rate was 9.3% and that it was the highest in those who were 70–79 years of age (14.4%) compared to those who were ≥80 years old (8.4%)⁵². Toi et al. reported that the recurrence rate in those who were 75–80 years of age was the highest and that of those older than 80 years of age was decreased⁷.

The impact of antithrombotic drugs on recurrence following surgical intervention for CSDH, however, is controversial^{13,52,53}. Goto et al. and Fujitani et al. reported that there was no significant difference in recurrence between patients treated with antithrombotic drugs and those without treatment^{52,54}. On the other hand, Wada et al. reported that the recurrence rate of CSDH in patients receiving antiplatelet agents was significantly associated with recurrence⁵⁵. However, they demonstrated that they could achieve a major reduction in the impact of antiplatelet agents by delaying the initial surgery by just 1 day⁵⁵.

Protection from Recurrence

Medical treatments such as carbazochrome, the Chinese herb Gore-san, and steroids have been

used to protect patients from recurrence of CSDH. Several reports have demonstrated a reduction in the recurrence of CSDH; however, most studies were retrospective and could not show the significant effects^{36,56,57}.

For patients with repeated recurrence of CSDH, use of a neuroendoscope during surgery to cut the trabecula and to separate the membrane of the intrahematoma cavity has been reported^{14,58}. Majovsky et al. reported on the use of flexible endoscope-assisted evacuation of CSDH, and this technique could reduce the recurrence rate¹⁴.

Embolization of the middle meningeal artery (MMA) for protection from recurrence of CSDH was first reported by Mandai et al. in 2000⁵⁹. The diameter of the MMA on one side of the CSDH is larger than that of the opposite side⁶⁰, thus, the MMA may be related to the bleeding mechanism. Although the access route to the MMA in elderly patients is not very easy, the technique is simple; hence, this treatment is acceptable for repeated recurrences in elderly patients^{61,62}.

To protect from or reduce the risk of recurrence of CSDH, use of artificial cerebral spinal fluid, has been reported; however, there is no scientific evidence for the effectiveness of this technique⁶³.

Resumption of antithrombotic drugs after evacuation surgery for CSDH is highly variable, and so far there have been no guidelines regarding the timing of resumption³⁸. Kawamata et al. recommended that anticoagulants may be resumed 3 days after surgery in patients with a high thromboembolic risk⁶⁴. Recently, MoGuha et al. reported that resumption of antithrombotic drugs following surgical evacuation of CSDH should be at 3 days postoperatively because patients with a history of preoperative antithrombotic drugs experienced thromboembolic complications significantly earlier than those patients without antithrombotic drugs, which peaks at 3 days postoperatively, with no increased hemorrhage risk when antithrombotic drugs were restarted⁶⁵. On the other hand, Kamenova et al. reported that there was no significant increase in the recurrence rate of CSDH after evacuation surgery between patients with early resumption of aspirin and those with late resumption¹⁷. Resumption of antithrombotic drugs should be started as soon as possible if a patient has a high risk of thrombosis.

Outcomes in Elderly Patients with CSDH

Surgical treatment can bring about rapid clinical improvement with favorable outcomes in 70–90% of patients, and there is no significant difference

with age.^{1,12,20,66)} However, outcomes in patients over 75 years of age were significantly worse than those younger than 75 years of age^{12,15,67)}. Ooba et al. reported that outcome improvement in patients over 80 years was lower than that under 80 years (86% vs. 95%, $P < 0.05$)²⁷⁾. Moreover, Karibe et al. reported that outcomes in patients over 70 years old were significantly worse than in those under 70 years old³⁾. Toi et al. reported that age-specific frequencies of poor outcomes at discharge were 11.7%, 20.4%, 37.4%, and 56.8% for patients younger than 70 years old, or in their 70s, 80s, or 90s, respectively⁷⁾.

Mortality rate of CSDH in the hospital has been shown to be between 0.21% and 27.5%^{3,4,7,12,15,16,18,20,51,68)}. Borger et al. demonstrated that mortality was still low in elderly patients; however, that in patients over 75 years old was significantly higher than that in patients less than 75 years old (75–84 years, 3.6%; older than 85 years, 3.8%; younger than 75 years, 1.7%)¹²⁾. Weigel et al. reviewed 48 publications about CSDH and indicated a modest average mortality rate of 2.8%. However, most publications have reported the short-term outcome and mortality rate. Miranda et al. demonstrated the long-term outcomes of elderly patients (average age 80.6 years) with CSDH and reported that the mortality rate in the hospital was 16.7%, and only 21.1% of patients returned home¹⁸⁾. Six-month and 1-year mortality rates after discharge were 26.3% and 32%, respectively¹⁸⁾. They concluded that CSDH in the elderly is no longer a benign disease¹⁸⁾ (Table 2). Several reports have also demonstrated a high mortality rate both in the hospital and in long-term follow-up^{4,19,48,68)}. Mean survival periods was significantly short according to the age of onset and

average survival was 1.5 ± 0.6 years in patients over 85 years old⁶⁸⁾. Causes of death in elderly patients with CSDH were disturbance of consciousness at onset and pneumonia after surgery⁴⁸⁾.

In recent reports from the US and Europe, discharge destination has been discussed. Most reports demonstrated that discharge directly home was significantly associated with increased long-term survival and discharge to a nursing home was associated with decreased long-term survival^{18,19,51,68)} (Table 3). In Japan, although more than 90% of patients younger than 70 years old were discharged home, a tendency toward lower rates was seen with increasing age of the patient. Approximately 30% of patients in their 80s and 40% of patients in their 90s could not be discharged home and were transferred to a rehabilitation hospital or nursing home⁷⁾. Stipper et al. also reported that in patients over 90 years old with CSDH, only 24% of them returned home⁶⁹⁾.

CSDH is an important cause of morbidity and mortality, and it has been described as a “sentinel health event” indicating underlying systemic pathology⁶⁸⁾. CSDH is associated with reduced long-term survival.

Future Issues and Problems of CSDH in the Elderly

According to the recent literature, the incidence of CSDH has been progressively increasing, and the long-term outcomes of CSDH patients are poor in spite of recent various medical and surgical treatments^{18,70)}. However, useful primary prevention has not been established, and none of these treatments are supported by Class I evidence⁴⁰⁾. So far, it is very difficult to establish an experimental animal model

Table 2 Mortality rate at discharge and over the long term

	In hospital	6 months	1 year
Jones and Kafels (1999) ($n = 43$, 83.8 y.o.)	4.7%	31%	–
Asghar et al (2002) ($n = 40$, 79 y.o.)	27.5%	33%	–
Santarius et al (2009) ($n = 215$, 76.8 y.o.)	5.7%	13.3%	–
Miranda et al (2011) ($n = 209$, 80.6 y.o.)	16.7%	26.3%	32%
Dumont et al (2013) ($n = 287$, 75y.o.)	8%	–	30%
Manickam et al (2016) ($n = 155$, 69.3 y.o.)	8.39%	14.19%	20.35%

n : number of patients, Ages shown are average ages during the study.

Table 3 Discharge destination and average long-term survival periods. Lengths in years shown in first column represent average survival periods for each report. Lengths in years in the Dumont study represent the average survival period for each destination, respectively

	Home or self-care	Acute rehabilitation	Nursing home
Miranda et al (2013) ($n = 174$, 4.4 years)	21.1%	62.2%	
Dumont et al (2013) ($n = 267$, 4.0 years)	55% 6.7 years	16% 3.5 years	29% 1.5 years
Stipper et al (2013) ($n = 21^*$, NA)	24%	14%	38%
Manickam et al (2016) ($n = 152$, 5.29 years)	60.7%	6.45%	6.45%

*: All patients were aged 90 years and older.

of CSDH. Therefore, we cannot understand the exact mechanisms of the increase in CSDH. In the future, it will be important to find the mechanisms of onset and recurrence of CSDH and more effective medical treatments and noninvasive surgical techniques for elderly patients should be developed.

Conflicts of Interest Disclosure

The authors report no conflicts of interest.

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