

## Causes, clinical presentation, management, and outcomes of chronic subdural hematoma at Mbarara Regional Referral Hospital

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**OBJECTIVE** Causes, clinical presentation, management, and outcomes of chronic subdural hematoma (CSDH) in low- and middle-income countries are not well characterized in the literature. Knowledge regarding these factors would be beneficial in the development and implementation of effective preventive and management measures for affected patients. The authors conducted a study to gain a better understanding of these factors in a low-income setting.

**METHODS** This prospective study was performed at Mbarara Regional Referral Hospital (MRRH) in Uganda between January 2014 and June 2017. Patients of any age who presented and were diagnosed with CSDH during the aforementioned time period were included in the study. Variables were collected from patients' files at discharge and follow-up clinic visits. The primary outcome of interest was death. Secondary outcomes of interest included discharge Glasgow Coma Scale (GCS) score, ICU admission, wound infection, and CSDH recurrence.

**RESULTS** Two hundred five patients, the majority of whom were male (147 [72.8%]), were enrolled in the study. The mean patient age was 60.2 years (SD 17.7). Most CSDHs occurred as a result of motor vehicle collisions (MVCs) and falls, 35.6% (73/205) and 24.9% (51/205), respectively. The sex ratio and mean age varied depending on the mechanism of injury. Headache was the most common presenting symptom (89.6%, 173/193), whereas seizures were uncommon (11.5%, 23/200). Presenting symptoms differed by age. A total of 202 patients underwent surgical intervention with burr holes and drainage, and 22.8% (46) were admitted to the ICU. Two patients suffered a recurrence, 5 developed a post-operative wound infection, and 18 died. Admission GCS score was a significant predictor of the discharge GCS score ( $p = 0.004$ ), ICU admission ( $p < 0.001$ ), and death ( $p < 0.001$ ).

**CONCLUSIONS** Trauma from an MVC is the commonest cause of CSDH among the young. For the elderly, falling is common, but the majority have CSDH with no known cause. Although the clinical presentation is broad, there are several pronounced differences based on age. Burr hole surgery plus drainage is a safe and reliable intervention. A low preoperative GCS score is a risk factor for ICU admission and death.

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**KEYWORDS** chronic subdural hematoma; low- and middle-income countries; neurosurgical access

**C**HRONIC subdural hematoma (CSDH) is a common clinical diagnosis among neurosurgical ward patients.<sup>18,20,39,42</sup> The elderly represent up to 90.9% of those with CSDH.<sup>20</sup> In fact, Jones and Kafetz found the average age of their patients in England to be 83.8 years.<sup>18</sup> In

Africa, the patient demographics differ. In Nigeria, Adeolu et al. observed that only 28% of the CSDH patients in their study were elderly, and Mezue et al. reported a peak age of 60 years, whereas Dakurah et al. recorded an average age of 46.9 years in Accra, Ghana.<sup>3,11,27</sup> It has been suggested

**ABBREVIATIONS** CSDH = chronic subdural hematoma; GCS = Glasgow Coma Scale; HIC = high-income country; LMICs = low- and middle-income countries; MRRH = Mbarara Regional Referral Hospital; MVC = motor vehicle collision.

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that unlike the situation in low- and middle-income countries (LMICs), people in high-income countries (HICs) live longer, creating a large elderly cohort, many of whom develop CSDH.<sup>18,20</sup>

Motor vehicle accidents and falls have been reported as the most common cause of CSDH.<sup>27</sup> Falls are especially common in the elderly, with one study from Japan reporting that 74% of the elderly CSDH population had a history of a fall.<sup>22</sup> Furthermore, it has been suggested that CSDH is an isolated contributor to recurrent falls or at least leads to an increase in the frequency of falling because of an altered mental state, neurological deficits, and postural disturbances.<sup>33</sup> Alcohol consumption has shown some correlation with the incidence of head injuries.<sup>4,17</sup> Brain contraction in the elderly further exacerbated by chronic alcohol abuse is also thought to be a contributing factor as it results in tension on the bridging vessels, which then easily tear during minor head blows or trauma.<sup>4,12,23,42</sup> Bleeding diatheses, secondary to alcoholic liver failure and chronic aspirin use, may also predispose patients. Other causes of CSDH are not well understood.

Treatment of CSDH using burr holes with or without drainage has persisted as the therapy of choice; in a few patients, craniotomy is warranted. In Ghana, Dakurah et al. reported recurrence and death rates of 2.1% and 2.1%, respectively.<sup>11</sup> In other studies from HICs such as the US and Sweden, the recurrence rate has varied widely, between 3% and 37%.<sup>21,26,42</sup> In a meta-analysis, Sahyouni et al. found that membranectomy during drainage of the CSDH did not lead to a statistically significant change in the morbidity, mortality, and recurrence rates, which were 3%–12%, 5%, and 10%–21%, respectively.<sup>37</sup> Success via nonsurgical management has been reported as well. In India, Bansal et al. reported the spontaneous disappearance of a large CSDH, whereas two studies from Japan documented good results with nonsurgical treatment of CSDH via the daily administration of tranexamic acid to patients.<sup>7,19,30</sup> Nevertheless, conservative treatment is not yet popular among neurosurgeons.

In LMICs, surgical treatment is often delayed because of several factors. The clinical presentation of CSDH has been reported to mimic those of several other medical conditions such as stroke, dementia, and Parkinson's disease, which are also prevalent in the same age group.<sup>2,4,22,24,33,40,45</sup> Additionally, neurosurgeons represent a small minority of physicians in LMICs, and advanced diagnostic imaging modalities such as CT and diagnostic centers are only available in urban areas.<sup>5,32</sup> As a result of this broad and unspecific clinical presentation and the lack of available diagnostic imaging and neurosurgeons, many patients may not be quickly referred to the neurosurgical ward, which can further delay surgery.

Overall, there is a dearth of literature on the causes, clinical presentation, management, and outcomes of CSDH in LMICs. Knowledge regarding these factors would be beneficial in the development and implementation of effective preventive and management measures for affected patients. To better understand these factors, we performed a prospective study at Mbarara Regional Referral Hospital (MRRH), one of two public hospitals in Uganda that provides neurosurgical services. The objective of this study

was to evaluate the causes, clinical presentation, and treatment outcomes of patients who presented with CSDH in this low-income setting.

## Methods

### Study Population and Setting

This study was conducted at MRRH, one of the 14 government referral hospitals in Uganda.<sup>28</sup> The hospital serves a population of over four million people in Southwestern Uganda and has a capacity of 600 beds and 8 ICU beds.<sup>6</sup> The staff consists of 410 persons, only one of whom is a neurosurgeon.<sup>15</sup> At MRRH, all neurological patients are admitted either through the accident and emergency department or through the neurosurgical outpatient department.

### Study Design

We performed a prospective observational study at MRRH from January 2014 to June 2017. Patients of any age who presented and were diagnosed with CSDH at MRRH during this time period were included in the study. Informed consent for study participation was obtained from all patients and/or caretakers when necessary.

### Intervention

All but three patients underwent general anesthesia. Three patients were sedated and underwent infiltration of the incision site with jungle juice (20 ml of 1% lignocaine and 0.1 ml of 1:1000 adrenaline solution) because of risks associated with general anesthesia given their age and very low level of consciousness. Surgeons placed two burr holes (frontal and parietal) with or without craniotomy. When membranes were observed through the burr holes, they were carefully opened after slight widening of the holes. All had irrigation with normal saline until the returning fluid was nearly clear. A closed drainage system (not vacuum) with a tube in the anterior hole (not subdural) was left in situ for 24–48 hours. Owing to a lack of resources, the drainage tube was a small pediatric nasogastric tube on which we tied a sterile glove or a urine bag to the opposite end for collecting fluid. Prophylactic antibiotics were used for 24–48 hours. Patients were followed up for infection and recurrence.

### Data Collection

We collected patient data on sociodemographics (age, sex, address, smoking and alcohol status), mechanism of injury, presenting symptoms (memory loss, confusion, urinary incontinence, limb weakness, seizures), admission vitals and neurological exam, laboratory and imaging findings, intervention received, and outcomes of interest. The primary outcome of interest was death. Secondary outcomes of interest included Glasgow Coma Scale (GCS) at discharge, ICU admission, CSDH recurrence, and wound infection. All data were collected using a paper case report form and subsequently entered into a password-protected database.

### Data Analysis

Descriptive statistics were used to describe the demo-

**TABLE 1. Patient demographics, presentation, and CSDH etiology**

Patient age in yrs, mean (SD)	60.2 (17.7)
Males, no. (%)	147 (72.8%)
Alcohol consumers, no. (%)	55 (26.8%)
Smokers, no. (%)	22 (10.7%)
Presenting complaint, no. (%)	
Headache	173 (89.6%)
Confusion	137 (71.7%)
Memory loss	116 (65.5%)
Convulsions	23 (11.5%)
Limb weakness	134 (70.5%)
Urinary incontinence	103 (65.6%)
Admission vitals & labs	
GCS score, no. (%)	
Mild (score 13–15)	131 (66.2%)
Moderate (score 9–12)	42 (21.2%)
Severe (score 3–8)	25 (12.6%)
SBP, median (IQR)	130 (120–140)
DBP, median (IQR)	80 (70–90)
Platelet count, median (IQR)	240 (190–308)
Mechanism of injury, no. (%)	
Intentional injury	17 (8.3%)
Fall	51 (24.9%)
MVC	73 (35.6%)
Sports injury	2 (0.9%)
No reported cause	62 (30.2%)
SDH type, no. (%)	
Chronic	137 (67.5%)
Subacute	66 (32.5%)
SDH laterality, no. (%)	
Rt	77 (42.3%)
Lt	66 (36.3%)
Bilat	39 (21.4%)

DBP = diastolic blood pressure; SBP = systolic blood pressure.  
Not all data were available for all patients.

graphics, presentation, admission vitals and labs, injury etiology, CT findings, treatment, and outcome data, though not all patients had data for each variable. The association between presenting complaint, mechanism of injury, SDH type, and outcomes with patient age was determined using the Student t-test and ANOVA. Variables found to have a significant association with the outcome of interest at a p value < 0.05 were considered statistically significant.

### Ethical Considerations

Ethics approval was obtained from Mbarara University of Science and Technology Research Ethics Committee.

## Results

### Patient Demographics and Presentation

We enrolled 205 patients, the majority of whom were

**TABLE 2. Association of presenting complaint, mechanism of injury, SDH type, and outcome with patient age**

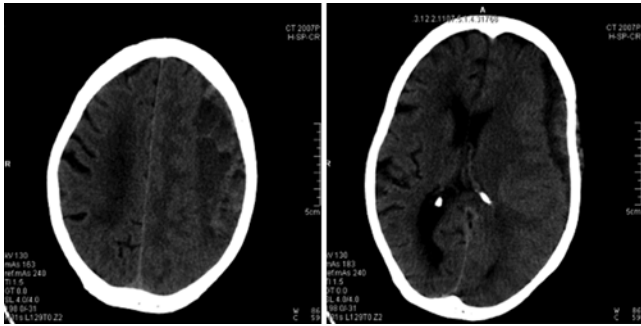
Variable	Mean Age (SD)	p Value
Presenting complaint		
Headache	58.7 (1.43)	<b>0.003</b>
Confusion	61.8 (1.60)	<b>0.043</b>
Memory loss	63.0 (1.64)	<b>0.025</b>
Convulsions	50.2 (4.46)	<b>0.005</b>
Limb weakness	64.7 (1.45)	<b>&lt;0.001</b>
Urinary incontinence	66 (1.59)	<b>0.001</b>
Mechanism of injury		
Intentional injury	49.8 (19.6)	
Fall	67.5 (13.9)	
MVC	52.5 (16.7)	<b>&lt;0.001</b>
Sports injury	37.5 (0.71)	
No reported cause	67.6 (15.5)	
SDH type		
Chronic	62.6 (17.72)	
Subacute	54.9 (16.17)	0.419
SDH laterality		
Rt	58.6 (18.64)	
Lt	59.4 (16.13)	0.419
Bilat	66.9 (16.47)	
Outcome		
ICU admission	70.5 (13.52)	0.051
Infection	63.8 (16.00)	0.82
Death	69.6 (16.51)	0.808

Boldface type indicates statistical significance.

male (72.8%, 147/202). The mean age of the patient population was 60.2 years (SD 17.7), while the median was 63 years (range 11–95). Only 13 patients were below the age of 35. Alcohol consumers and smokers made up 26.8% (55/205) and 10.7% (22/205) of the population, respectively. Headache was the most common presenting symptom (89.6%, 173/193), followed by confusion (71.7%, 137/191) and limb weakness (70.5%, 134/190), whereas seizures were uncommon (11.5%, 23/200; Table 1). The patients who presented with limb weakness (mean  $\pm$  SD in years:  $64.7 \pm 1.45$ ), memory loss ( $63.0 \pm 1.64$ ), and urinary incontinence ( $66 \pm 1.59$ ) were, on average, older than those who presented with seizures ( $50.2 \pm 4.46$ ) and headaches ( $58.7 \pm 1.43$ ; Table 2). The majority of patients in our cohort (66.2%, 131/198) were found to have an admission GCS score of 13–15. Median blood pressure on admission was 130/80, whereas the platelet count was 240. Figure 1 demonstrates imaging findings for a typical patient with CSDH associated with a fall.

### Etiology

Chronic subdural hematoma occurred in association with motor vehicle accidents and falls in 35.6% (73/205) and 24.9% (51/205), respectively (Table 1). Sex ratio and mean age varied depending on the mechanism of injury. More than 80% of the patients who developed CSDHs



**FIG. 1.** Axial CT scans obtained in an 80-year-old female with contusion. Three days before presentation, she had fallen down while ambulating. Note the extensive cortical atrophy.

after motor vehicle collision (MVC; 87.7%, 64/73) and intentional injury (82.4%, 14/17) were male; however, the percentage of males decreased to 58.8% (30/51) among the patients whose CSDH was associated with a fall (Fig. 2). Patients who reported falls and those with CSDH with no known cause were older ( $67.5 \pm 13.8$ ) than the patients with CSDH secondary to MVC ( $52.5 \pm 16.6$ ) or assault ( $49.8 \pm 19.6$ ; Table 2).

**Disposition**

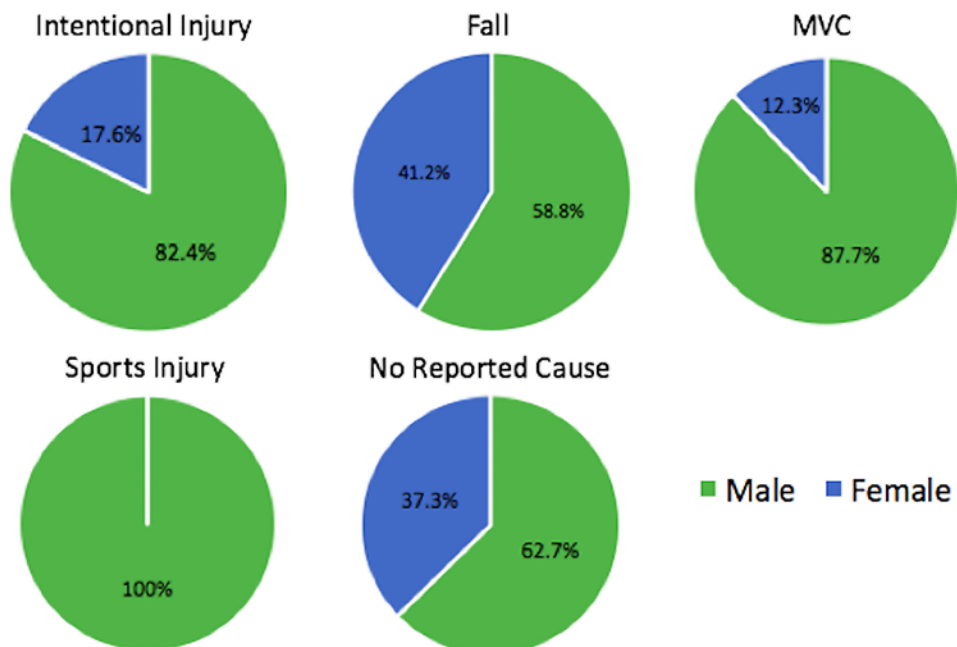
A total of 205 patients underwent surgical intervention with burr holes drainage plus a drain and 22.4% (46/205) were admitted to the ICU for management. Furthermore, CSDH recurred in 2 patients, whereas 5 patients developed a postoperative wound infection and 18 died. There was a statistically significant association between admission GCS score and discharge GCS score ( $p = 0.004$ ). Moreover, GCS score on presentation was a significant predictor of ICU admission ( $p < 0.001$ ) and death ( $p < 0.001$ ; Table 3).

**Discussion**

Chronic subdural hematoma is a common clinical diagnosis among neurosurgical ward patients, with an increasing prevalence worldwide.<sup>18</sup> While in HICs this occurrence has been attributed to an increase in the size of the elderly population, in LMICs there are additional risk factors such as a high incidence of trauma.<sup>10,16</sup> Overall, there is a lack of published data on the epidemiology, patterns, and clinical presentations of this condition in LMICs. In this study, we sought to evaluate the causes, clinical presentation, and treatment outcomes of CSDH in a low-income setting in order to better guide the development and implementation of effective preventive and management measures for affected patients.

In our study, the CSDH patients tended to be younger than those previously reported in HICs. While we report a mean age of 60.2 years, studies from the UK and US have documented mean patient ages of 80.6 and 83.8 years, respectively.<sup>18,29</sup> Our finding may be attributable to a younger average age of the general population in Uganda as well as a higher incidence of trauma, which tends to affect younger patients.<sup>1,10,16,34</sup> Additionally, within this Ugandan cohort, we found an overall preponderance of males, with a ratio of 2.5:1, which is slightly higher than the 1.7:1 ratio noted in a study based in the US.<sup>29</sup> Furthermore, among those who had trauma in our study, the ratio of males to females was 6.7:1, even higher than the male to female ratios reported for CSDH patients in Nigeria.<sup>10,16</sup>

Our data revealed that MVCs were the most common reason for CSDH occurrence, echoing findings in the literature, which indicates that MVC is the commonest cause of traumatic brain injury in LMICs.<sup>5,13,32</sup> However, falls were reported in only 25% of the patients in our study, a lower rate than those documented in the literature from the UK and US.<sup>4,18</sup> We also demonstrated that trauma (MVC, in-



**FIG. 2.** Etiology of CSDH at MRRH, stratified by patient sex.

TABLE 3. CSDH outcomes at MRRH

Variable	Total No. (% of known*)	Admission GCS Score (% of known*)			p Value
		13–15	9–12	3–8	
Discharge GCS score, no. (%)					
Mild (score 13–15)	182 (98.9%)	126 (71.6%)	36 (20.5%)	14 (8.0%)	<b>0.004</b>
Moderate (score 9–12)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
Severe (score 3–8)	2 (1.1%)	0 (0%)	0 (0%)	1 (100%)	
ICU admission, no. (%)	46 (22.4%)	8 (17.8%)	16 (35.6%)	21 (46.7%)	<b>&lt;0.001</b>
Postop infection, no. (%)	5 (2.4%)	2 (40.0%)	2 (40.0%)	1 (20.0%)	0.448
Death, no. (%)	18 (9.0%)	3 (17.7%)	4 (23.5%)	10 (50.8%)	<b>&lt;0.001</b>

Boldface type indicates statistical significance.

\* Not all patients included in the study had each of the specific variables documented. Analogously, not all patients with an admission GCS score had data for each of the variables in the far left column.

tended injury, sports) was the cause of CSDH in a younger patient subset than that presenting with CSDH associated with falls or unknown etiology. In this latter category, falling may not necessarily be the cause of CSDH, but rather a symptom of CSDH. In elderly patients, CSDH can occur spontaneously due to the presence of cortical atrophy and the resultant strain on bridging veins.<sup>4,12,23,42</sup> Thus, the occurrence of a CSDH can predate a fall given that the hematoma causes an altered mental state, neurological deficits as well as postural disturbance, and there may be frequent falls before presentation.<sup>4,18</sup> Wali et al. referred to this as the “ease of falling” syndrome.<sup>45</sup> In fact, in our study, we saw several patients who presented after a simple fall sustained while walking or during common daily activities, which had occurred 2–7 days earlier; however, they were found to have an older hematoma on CT imaging (Fig. 1).

Headache was the most common presenting symptom in our patients, followed by confusion. These findings are in line with previous studies from Nigeria and Ghana.<sup>11,27</sup> Other studies from the US have noted that headache was less common in the elderly, attributing this finding to the early onset of confusion and brain atrophy in this age group.<sup>14</sup> Convulsions were a rare presentation of CSDH in our cohort, similar to findings by other investigators, who have reported a prevalence ranging between 2.3% and 19% among patient cohorts in Romania and the US.<sup>9,17,24</sup> Moreover, patients who presented with seizures, both within our cohort and those across the literature from HICs, were, on average, younger than those presenting with other symptoms.<sup>17</sup> The preponderance of convulsions among the young may be a result of a more active response to brain trauma leading to acute edema.<sup>8</sup>

In this study, we report good patient outcomes associated with the operative management of CSDH. Only four patients developed a postoperative superficial wound infection, and one patient developed a subdural empyema, resulting in an infection rate of 2.4% (5/205). This low infection rate was consistent with the findings published from Nigeria and Greece.<sup>3,35</sup> Meanwhile, an older study from Germany reported a postoperative infection rate of 18.1% and concluded that CSDH burr hole drainage plus a drain can promote infection and further hemorrhage. Our results did not support this finding.<sup>38</sup> Furthermore, less than 1% of patients in our cohort had a CSDH recurrence

after surgical intervention, similar to rates reported by previous studies from Nigeria and Ghana.<sup>3,11,17,37</sup> Studies from the US, Germany, and Greece have reported higher CSDH recurrence rates due to additional patient cohort risk factors, including a history of alcohol consumption, the presence of hemorrhagic diatheses, and anticoagulant use.<sup>25,26,31,35,36,41–43</sup> The reason for low recurrence rates could be attributed to the low prevalence of alcohol use. Because of the limited laboratory capacity at MRRH, we could not assess patients’ INR (international normalized ratio) prior to surgery; however, platelets were found to be within normal range for all patients.

The mortality rate in our patient cohort was 8.8% (18/205). In Nigeria and Ghana, Mezue et al. and Dukurah et al. reported lower mortality rates of 0.8% and 2.1%, respectively.<sup>11,27</sup> In a meta-analysis, Sahyouni et al. found mortality rates of 5% and 3.7% among patients undergoing surgical management of CSDH with and without a membranectomy, respectively.<sup>37</sup> Thus, the death of patients undergoing surgical intervention in our study was comparable. Moreover, death in our study was associated with an older age and low admission GCS score. Previously published studies from the US and Belgium have recognized that age and level of consciousness on admission are the most important predictors of prognosis in traumatic brain injury patients.<sup>12,36,44</sup>

### Study Limitations

There are several limitations to our study. Our sample size was limited to only 205 patients, thus making it difficult to determine whether our findings over- or underestimate the true frequencies of patient presentation, injury mechanisms, and outcomes. Moreover, this study was limited to one referral hospital located in Southwestern Uganda, thus making it difficult to extrapolate our conclusions to other populations that are more urbanized or more rural. Additionally, given that the data were collected from patient files completed upon patient discharge, some data were missing.

### Conclusions

This study served to characterize the causes, clinical presentation, and treatment outcomes of patients who pre-

sented with CSDH at MRRH. Trauma, in particular MVC, was a common cause of CSDH among younger patients, whereas falling was the most frequent etiology among the elderly population. Although the clinical presentation is broad, several pronounced differences in clinical presentation were noted. Headache and convulsion were common in the young, whereas other factors (falling, limb weakness, confusion, urinary problems) were found to affect the elderly. Burr hole surgery with closed drainage was a safe and reliable procedure in the treatment of CSDH. A low preoperative GCS score is a risk factor for ICU admission and death.

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### Author Contributions

Conception and design: Kitya, Obiga. Acquisition of data: Kitya, Punchak, Obiga. Analysis and interpretation of data: Kitya, Punchak. Drafting the article: Kitya, Punchak. Critically revising the article: Kitya, Punchak, Harborne. Reviewed submitted version of manuscript: Kitya, Punchak, Harborne. Approved the final version of the manuscript on behalf of all authors: Kitya. Statistical analysis: Punchak, Abdelgadir. Administrative/technical/material support: Kitya, Obiga, Haglund. Study supervision: Kitya, Haglund.

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