Supplementary File 1

EXTENDED METHODS

Intervention

Provider instructions spinal anaesthesia

Spinal anaesthesia should be performed as a single-shot block. Supporting adapted sedation is permitted for block placement and intraoperative comfort of the patient. The level of sedation should be assessed by the Observer´s Assessment of Alertness/ Sedation Scale (OAA/S) (Table 2), a simple, validated measure of alertness among sedated subjects.[49] The intraoperative alertness/ sedation depth should correspond to OAA/S ≥2. Documentation of OAA/S should be performed every 30 minutes or at least once during surgery, irrespective of the use of active sedation. If clinically required, conversion to general anaesthesia is permitted. All remaining aspects of anaesthesia care, e.g. monitoring, drugs and dosage, postoperative pain management, supplemental nerve blocks, and management of intraoperative events should be handled as per usual routine. Optional assessment: If a bispectral index (BIS)-monitoring is available and used at the institution.

Supplementary File Table 1: Observer's Assessment of Alertness/Sedation[49]

Score	Subject responsiveness	Sedation level
5	Responds readily to name spoken in normal tone	Alert
4	Lethargic response to name spoken in normal tone	Light sedation
3	Responds only after name is called loudly and/or repeatedly	Moderate sedation
2	Responds only after mild prodding or shaking	Moderate sedation
1	Does not respond to mild prodding or shaking	Deep sedation

Provider instructions general anaesthesia

Maintenance of general anaesthesia with an inhaled anaesthetic or continuous intravenous application of propofol: Intravenous opioids should be applied as needed for intraoperative analgesia. Airway management should be performed as usual in

the respective centre (e.g. via endotracheal tube, laryngeal mask airway, or other device). All remaining aspects of anaesthesia care, e.g. monitoring, drugs and dosage, postoperative pain management, supplemental nerve blocks, and management of intraoperative events should be handled as per usual routine. Optional assessment: If a BIS-monitoring is available and used at the institution.

Data collection

Visit 0 (Screening visit), pre-randomization phase

The investigator/ study staff will screen all potentially eligible patients between the time of presentation and surgery. This will be followed by a screening visit, to check if the patient meets inclusion criteria in the absence of exclusion criteria. Investigators will obtain written informed consent from eligible patients or their legal representatives, after study-specific patient information.

Visit 1 (Preoperative evaluation visit), pre-randomization phase

The pre-evaluation visit will also be conducted between the time of presentation and surgery via patient or proxy interview. It will comprise the assessment of the patient demographics, medical history, the most recent preoperative routine laboratory values, vital data, clinical data, residential and educational status and the overall health and disability assessment belonging to the study-specific baseline testing. Further study-specific baseline testing (cognition, delirium, pain, and depression) and frailty assessment will be performed directly via patient interview, independent of the cognitive status of the patient. Additionally, we will document the contact data of the patients and the proxy, as well as the "do not resuscitate" status of the patient.

Baseline data to be collected:

- Patient demographics (age, sex, race, weight, height, body mass index (BMI), American Society of Anaesthesiologists (ASA) physical status)
- Educational and residential status; patient and proxy contact information; do not resuscitate status
- Pre-existing diseases and medical history, including medication and risk factors (smoking status, alcohol status)

- Supplemental oxygen or mechanical ventilation, baseline vital data including blood pressure, heart rate and oxygen saturation.
- Ability of walking 3 m across the room prior to hip fracture
- Type of hip fracture and planned kind of surgery
- Most recent preoperative routine laboratory values, if done in the clinical routine: haemoglobin, haematocrit, MCV, white blood cells, serum creatinine, urea, albumin, protein (total), calcium (total), potassium, sodium, AST, alkaline phosphatase, TSH, platelets, INR and PTT

Study-specific testing: baseline assessment prior to surgery:

Cognition will be assessed by the validated Short blessed test (SBT), which enables a brief screen of cognition via in-person and telephone interview (5-10 minutes).[34]

Delirium will be assessed via in-person interview by the validated, high sensitive and specific assessment tool 3D-Confusion Assessment Method (3D-CAM) (3-5 minutes).[30]

The overall health and disability will be assessed via the 12-item World Health Organization Disability Assessment Schedule 2.0 (WHODAS 2.0), which can be administered in person as well as via telephone interview in 5-10 minutes. The WHODAS 2.0 is a patient-reported outcome assessment tool, which comprises: cognition, mobility, self-care, interpersonal relationships, work and household roles, and participation in society.[35]

Depression will be assessed via the short version of the Geriatric Depression Scale (GDS) (5 min.).[36]

Frailty assessment will be performed according to phenotype-model of Fried at baseline via in-person interview.[37] Four of originally five Fried-criteria will be assessed: fatigue, maximal grip strength assessment of the dominant hand, physical activity (employing the Minnesota Leisure Time Activities Questionnaire) (5-10 min.) and weight loss in the past year. Gait velocity as the fifth Fried criterion will be omitted in this study for obvious reasons. We will also obtain laboratory results.

Pain will be assessed via numeric rating scale (NRS 0-10) and questions derived from the Brief Pain Inventory.[31] We will assess the average and worst pain within the past 2 weeks before hip-fracture and the actual pain level.

Visit 2 (Hip-fracture surgery), intervention phase

The investigator will randomize the patient, after a short re-evaluation of patient eligibility and the eligibility of the attending routine team in the operating room. The patient will not be randomized, if the attending anaesthesia and surgery team is unwilling or ineligible (as judged by the principle investigator) to treat study patients. The attending anaesthesia team will be informed by study staff about the assigned study group after randomization. The routine attending anaesthesia team (does not necessarily have to belong to the study team) will perform the study treatment during the clinical routine in accordance with the pragmatic study protocol. Sedation/ alertness level for patients in the spinal anaesthesia group will be documented according to the OAA/S. BIS values will optionally be documented, if used in the clinical routine during both procedures. Other routine surgical- and anaesthesia-related data (e.g. monitoring-devices, patient vital data, used drugs and dosages, times, adverse events (AEs), discharge destination after surgery etc.) will be collected via medical record review.

Data to be collected:

- Observer's assessment of alertness scale (OAA/S) (alertness/ sedation level), optional BIS-monitoring, other monitoring, clinical management
- Medical record review including but not limited to date of surgery, time to surgery, procedure type/ implant, anaesthesia and surgery time, use of a safe-surgery checklist, blood loss, transfusion, infusion, blood pressure (including pre-induction blood pressure, lowest intraoperative blood pressure, and the duration of a systolic blood pressure less than 20% from baseline), oxygen saturation, initial anaesthesia type, intrathecal agents administered, peripheral nerve blocks, benzodiazepines, intravenous opioids, anaphylaxis, aspiration, orthogeriatric care available
- Adverse Events (AEs) and serious adverse events (SAEs) according to the patient interview and medical charts

Visit 3-5 (Postoperative day 1-3), in-hospital patient-centred outcome phase

Daily assessment of delirium, pain and mortality via patient visit and interview on ward, if the patient is still in hospital. Documentation of AEs will occur via additional medical record review. Blinding will be encouraged during the first 4 postoperative visits, but it is not mandatory. A second investigator will perform these visits in a blinded manner as far as possible in the clinical routine. It will be documented for each visit, if blinding was preserved.

Study-specific in-person assessment on the 1st-3rd postoperative day, if the patient is still in hospital:

- Delirium (3D-CAM) assessment (3-5 min)
- Postoperative mortality assessment (2-5 min)
- Pain assessment via numeric rating scale (0-10). The average and worst pain within the past 24 hours, quality of pain (5 min.) derived from the German pain questionnaire.[32]
- AEs and SAEs according to the patient interview and medical charts

Visit 6 (Postoperative day 4), in-hospital patient-centred outcome phase

Delirium, pain, mortality, and patient satisfaction will be assessed via patient visit and interview on ward, if the patient is still in hospital. If the patient is discharged before postoperative day 4, patient satisfaction will be assessed in addition to the respective visit 3-5. Documentation of AEs will occur via additional medical record review.

Blinding will be encouraged during the first 4 postoperative visits, but it is not mandatory. A second investigator will perform visit 6 in a blinded manner as far as possible in the clinical routine. It will be documented for this visit, if blinding was preserved.

Study-specific in-person assessment on the 4th postoperative day or at discharge (whatever occurs first), if the patient is still in hospital

- Delirium (3D-CAM) assessment (3-5 min)
- Postoperative mortality assessment (2-5 min)
- Pain assessment via numeric rating scale (0-10). The average and worst pain within the past 24 hours. Pain quality (5 min.)
- Bauer Patient Satisfaction Questionnaire (3 min.)

- AEs and SAEs according to the patient interview and medical charts

Visit 7 (Hospital discharge day), in-hospital patient-centred outcome phase

All cause mortality, new-onset complications according to the NSQIP[27], other AEs, admission to Intensive Care Unit (ICU), length of stay in hospital and ICU, discharge destination, independence in walking, pain assessment, and medical pain management until postoperative day 4 will be assessed via medical record review and patient visit and interview on ward. This visit will be performed in addition to visit 3-6, if the hospital discharge occurs within the first 4 postoperative days. Blinding for Visit 7 will not be required.

Study-specific in-person and medical record assessment on the hospital discharge day

- In-hospital mortality (2-5 min); new-onset complications (bleeding requiring transfusion, myocardial infarction, congestive heart failure, stroke or transient ischemic attack, pneumonia, urinary tract infection, wound infection, systematic sepsis, thromboembolic complications, unplanned intubation, ventilator > 48 hours, acute renal failure, cardiac arrest requiring CPR or defibrillation, epidural haematoma requiring surgery, new paralysis of lower extremities, return to operating room, inpatient falls, unplanned postoperative mechanical ventilation, additional surgeries) (30-60 min)
- Assessment of admission to critical care, length of intensive care and hospital stay, discharge destination (5-10 min); Independence in walking (5 min)
- Pain assessment via numeric rating scale (0-10). The average and worst pain within the past 24 hours, quality of pain (5 min.)
- Medical pain management until postoperative day 4
- AEs and SAEs according to the patient interview and medical charts

Visit 8 (Postoperative day 30 ± 3), post-discharge patient-centred primary outcome phase

Will be performed in a blinded manner via medical record review and telephone interview of the patient or rather the proxy. In case of serious cardiac or pulmonary complications, the family physician and / or the respective hospital will be contacted

in addition. Assessment of all-cause mortality or new-onset (i.e. not pre-existing at time of surgery) serious cardiac and pulmonary complications as defined by the NSQIP[27]. Furthermore, assessment of the secondary outcomes: Recovery of walking, pain intensity and quality, residential status, cognition, overall health and disability assessment and pain.

Study-specific follow-up on the 30 ± 3th postoperative day (via telephone interview)

- All-cause mortality and new-onset serious cardiac and pulmonary complications (see 7.1) (10-15 min)
- Recovery of walking, residential status (5 min)
- WHODAS 2.0 (overall health and disability) (5-10 min)
- Short Blessed Test (cognition) (5-10min),
- Pain assessment via numeric rating scale (0-10). The average and worst pain within the past 2 weeks, quality of pain, intake of pain medication (5 min.)

Visit 9 (Postoperative day 180 ± 45), post-discharge patient-centred long-term outcome phase

Assessment of mortality, recovery of walking, residential status, cognition, overall health and disability assessment and pain intensity and quality via telephone interview of the patient or rather the proxy in a blinded manner.

Study-specific follow-up on the 180 ± 45th postoperative day (via telephone interview)

- All cause mortality assessment (2-5 min)
- Recovery of walking, residential status (5min)
- WHODAS 2.0 (overall health and disability) (5-10 min)
- Short Blessed Test (cognition) (5-10 min)
- Pain assessment via numeric rating scale (0-10). The average and worst pain within the past 2 weeks, quality of pain, intake of pain medication (5 min.)

Visit 10 (Postoperative day 365 ± 60), post-discharge patient-centred long-term outcome phase

Assessment of mortality, recovery of walking, residential status, cognition, overall health and disability assessment and pain intensity and quality via telephone interview of the patient or rather the proxy in a blinded manner.

Study-specific follow-up on the 365 ± 60th postoperative day (via telephone interview)

- All cause mortality assessment (2-5 min)
- Recovery of walking, residential status (5min)
- WHODAS 2.0 (overall health and disability) (5-10 min)
- Short Blessed Test (cognition) (5-10 min)
- Pain assessment via numeric rating scale (0-10). The average and worst pain within the past 2 weeks, quality of pain, intake of pain medication (5 min.)

Dropout-handling and protocol deviations

Patients who withdraw their consent after randomization or who cannot be contacted for follow-up assessments will be handled as dropouts. Patients who withdraw consent before randomization will be considered as screening failures. All randomized patients (also with protocol deviations) will be followed up as long as possible according the intention-to-treat concept. Particularly, patients, who receive a treatment change (protocol deviation) have also to be followed up and will not be considered as dropouts, but the reason has to be documented clearly.

Sponsor monitoring

The CTC-A will be responsible for quality assurance through regular on-site monitoring, data and query management, reporting of AEs and annual safety reports. The CTC-A maintains a Quality Management System (QMS) for Clinical Trials and regularly implements Quality Assurance and Quality Control measures alongside the development and design as well as performance and reporting of clinical trials. The quality management system of the CTC-A complies with all relevant guidelines and also comprises a data protection system according to the Act to Strengthen the Security of Federal Information Technology. The quality management system consists of the quality management handbook and the quality assurance handbook, comprising standard operating procedures (SOPs), working instructions, forms, templates and checklists for all relevant tasks in accordance with the Helsinki Declaration, International Conference on Harmonisation Guideline for Good Clinical Practice (ICH-GCP), German Medical and Medical Device Act.

Monitoring procedures include four visits per site designed to clarify all prerequisites before the study commences (including initiation visit and close-out visit). Interim monitoring visits will take place on a regular basis according to a mutually agreed schedule. During these visits, the monitor will check for 100% subject eligibility (informed consent form; in- and exclusion criteria). Risk-based monitoring will be used for completion of the entries on the eCRF/CRF and the integrity of the source data with the eCRF/CRF entries. Furthermore the monitor will check the compliance with the clinical study protocol, ICH-GCP principles and the Declaration of Helsinki. Additionally, the monitor will check if all AEs and SAEs have been reported appropriately within the time periods required. The investigator and all staff will be expected to cooperate with the monitor by providing any missing information whenever possible. Further details of monitoring activities will be set forth in the monitoring manual.