Norsk Nevrokirurgisk forening

Nevrokirurgisk høstmøte 2024

23. – 25. oktober – Legenes hus og konferansesenter, Oslo

Abstraktbok

Oversikt over foredragssesjoner

24. oktober 2024

Kl. 09:10 – 10:30 -- *Frie foredrag 1*
Kl. 15:15 – 16:05 -- *5 beste abstrakter*
Kl. 16:05 – 16:45 -- *Frie foredrag 2*

25. oktober 2024

Kl. 09:00 – 10:00 -- *Frie foredrag 3*
Kl. 11:15 – 12:00 -- *Frie foredrag 4*

Innholdsfortegnelse

Ten-Year Single-Center Study on Surgical Outcomes for Spontaneous Intracerebral Hematomas

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Frie foredrag 1, 24. oktober 2024, kl. 10.12 – 10.20

Background

Spontaneous intracerebral hemorrhage (sICH) is a severe neurological condition with a generally poor prognosis, often leaving patients with significant long-term disabilities. Surgical intervention is typically reserved for a selected group of patients due to the high risk of complications and uncertain outcomes. This study focuses on patients who underwent surgery for sICH at Haukeland University Hospital (HUS) between 2013 and 2022, aiming to evaluate their postoperative functional status and identify risk factors associated with poor outcomes.

Methods

This retrospective study utilized data from the Lifecare Orbit Surgery Management system to identify sICH patients who underwent surgical treatment at HUS. Data were extracted from electronic medical records, focusing on demographic information, clinical symptoms, hematoma characteristics, surgical interventions, and postoperative outcomes. The Modified Rankin Scale (mRS) was used to assess functional status before the hemorrhage and three months postoperatively. Only patients with available mRS data for both time points were included in the analysis.

Results

Among the 216 patients who underwent surgery for sICH, 100 met the study's inclusion criteria. Hypertension was identified as the most common comorbidity. Three months postoperatively, more than half of the patients (54%) had a poor functional outcome (mRS ≥ 4), with 23% having died (mRS 6). A significant worsening in mRS from preoperative status was observed ($p=0.037$). The 30-day survival rate was 85%. Independent risk factors for poor outcomes included age over 60 years, use of oral anticoagulants, and hemorrhages located in the basal ganglia or motor cortex.

Conclusion

The study highlights a trend towards higher disability and mortality rates three months after surgical intervention for sICH. A predictive score was developed, incorporating age, anticoagulant use, and hemorrhage location, which could assist in identifying patients who may benefit most from surgery. This tool may enhance decision-making in neurosurgical practice, potentially improving patient outcomes.

A first step towards the development of a functional Brain-Computer-Interface

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Frie foredrag 2, 24. oktober 2024, kl. 16.15 - 16.23

Background
Spinal cord injury (SCI) and stroke are devastating and incapacitating conditions that lead to significant motor and sensory impairments and often require expensive lifelong care. These conditions arise due to neuronal tissue damage and network disruptions that exceed the capacity for spontaneous repair. To date no biological cure exists for these patients. Brain-Computer-Interfaces have emerged as a promising strategy to improve the quality of life.

Objective
This study aims to establish intention decoding of brain signals from locomotion and hand/arm movements. These decoded signals will be transformed into electrical commands by an automated Al-algorithm to guide a robotic exoskeleton arm, mirroring the intended actions.

Design/methods
The study will utilize brain signals retrieved from intracranial electrodes implanted in epileptic patients. These patients have deep electrodes implanted as part of their routine clinical treatment to identify the epileptic focus. This allows the capture of brain signals during intentional movement tasks such as hand grasping. We will also explore the complex sequence of signals that occurs during the planning of a grasping task.

Discussion
The results of this study will contribute to a better understanding of intention related motor function. It will serve as a first step towards the development of a functional Brain-Computer-Interface to support patients with devastating motor deficits.

Working status in patients with untreated unruptured intracranial aneurysms - a descriptive longitudinal study

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Frie foredrag 1, 24. oktober 2024, kl. 09.10 - 10.18

Background
Many patients with unruptured intracranial aneurysms (UIAs) remain untreated if the risk of treatment exceeds the estimated risk of aneurysm rupture, potentially leading to diagnosis-related stress and anxiety. Working status may serve as a marker for the total level of function including mental health and psychological burden of the condition. The aim of the study was to assess the working status before and after a diagnosis of an untreated UIA.

Methods
This was a retrospective nationwide registry-based descriptive longitudinal study. It included all working-age patients diagnosed with an UIA in Norway between 2008 and 2018 and 1:1 age- and sex-matched controls without a diagnosis of an intracranial aneurysm that were randomly selected from the Norwegian population. The history of sickness absence in the period one year before and after diagnosis was retrieved from The Norwegian Labour and Welfare Administration records and compared between the groups.

Results
2141 patients and 2141 controls were included in the study. Proportion of working patients decreased from 62.1% (95% confidence interval [CI] 60.0-64.1%) one year before the diagnosis to 51.3% (95% CI 49.1-53.4%) one year after the diagnosis ($p<0.001$). In comparison, the proportion of working controls decreased from 77.9% (95% CI 76.1-79.6%) one year before day 0 to 73.4% (95% CI 71.5-75.2%) one year after day 0 ($p=0.001$). The odds of working were 86.7% lower among the patients than among the controls (OR 0.133, 95% CI 0.091-0.194; $p<0.001$) when controlled for the baseline working status. The older the individuals, the less likely they were to work (OR 0.908, 95% CI 0.889-0.926; $p<0.001$).

Conclusion
The work participation of patients diagnosed with an UIA is low pre-diagnosis compared to the general population, and decreases significantly post-diagnosis.

Surgical versus conservative treatment for odontoid fractures in the elderly: an international prospective comparative study

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Frie foredrag 2, 24. oktober 2024, kl. 16.05 – 16.13

Introduction
Odontoid fractures are the most common cervical spine fractures in the elderly. The optimal treatment remains debated, while being increasingly relevant to clinical practice in the ageing population. The aim of the INNOVATE trial was to compare clinical outcome and fracture healing between surgically and conservatively treated patients.

Methods
An international prospective comparative study was conducted in fifteen European centers, involving patients aged ≥55 years, with type II/III odontoid fractures, no rheumatoid arthritis/ankylosing spondylitis, and no previous fracture treatment. The attending surgeon and patient made a shared decision on the applied treatment. Five follow-up moments were scheduled between 6 and 104 weeks. Primary outcomes were Neck Disability Index (NDI) improvement, fracture union and fracture stability at 52 weeks. Secondary outcomes were VAS neck pain, Likert patient-perceived recovery, and EuroQol-5D-3L at 52 weeks. Subgroup analyses considered age, type II fractures and displaced fractures. Multivariable regression analyses adjusted for age, gender and fracture characteristics.

Results
The study included 276 patients, of which 144 (52%) were treated surgically and 132 (48%) conservatively (mean (SD) age 77.3 (9.1) vs. 76.6 (9.7), p=0.56). NDI improvement (decrease) was largely similar between surgical and conservative treatments (mean (SE) -11 (2.4) vs. -14 (1.8), p=0.08), as were union (86% vs. 78%, aOR 2.3, 95% CI 0.97-5.7), and stability at 52 weeks (99% vs. 98%, aOR NA). NDI improvement did not differ between patients with union and persistent non-union (mean (SE) -13 (2.0) vs. -12 (2.8), p=0.78). There was no difference between treatments for any of the secondary outcomes or subgroups (Figure 1).

Conclusion
Clinical outcome and fracture healing at 52 weeks were similar between surgical and conservative treatments. Clinical outcome and fracture union were not associated. Conservative treatment is justified as primary treatment for odontoid fractures, prioritizing favorable clinical over radiological outcomes.

Initial experience with navigated, minimal-invasive pedicle screw placement in cervical spine injuries

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Frie foredrag 1, 24. oktober 2024, kl. 09.20 - 10.28

Introduction
Several studies have shown an increased stability of cervical pedicle screws over lateral mass screws, reducing the risk of construct failure and enabling shorter constructs with fewer screws and segments fused leading to less morbidity and reduced implant costs. However, the placement of pedicle screws in the cervical spine carries a higher risk of neurovascular injury than the placement of lateral mass screws. Neuro-navigation enables a safer screw placement and can be used to implant cervical pedicle screws with a minimal-invasive approach leading to reduced soft tissue damage and blood loss and less postoperative pain.
The aim of this project was to describe the initial experiences with navigated, minimal-invasive pedicle screw placement in injuries of the cervical spine.

Methods
This comparative pre/post study is part of an internal quality assurance (QA) project. Patients operated with posterior screw/rod constructs for cervical spine injuries before (pre-group) and after (post-group) introduction of navigated minimal-invasive approach (January 2024) were included.

Results
In this QA project 13 patients were included, 7 in the pre-group (open midline approach) and 6 in the post-group (minimal-invasive lateral approach). There were 10 male and 3 female patients, the average age was 60 years. In the pre-group 21 out of 57 screws were pedicle screws (36%), in the post-group 28 out of 28 were pedicle screws (100%). The average blood loss was 230 ml/screw in the pre-group and 37 ml/screw in the post-group. Postoperative imaging showed misplaced screws in 2 patients in the pre-group and none in the post-group. The length of stay was 7 days in the pre-group and 6 days in the post-group.

Conclusion
In our initial experience cervical pedicle screws can be placed safely through a navigated, mini-open approach. Blood loss and length of stay can be reduced with this technique.

Is There a Risk for Epilepsy After Endoscopic Third Ventriculostomy? Implications for Driving License Regulations

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Frie foredrag 2, 24. oktober 2024, kl. 16.35 - 16.43

Background

Endoscopic third ventriculostomy for hydrocephalus is perceived as a low-risk procedure among clinicians. However, complication rates, particularly post-operative seizure rates, are not well-established in the adult, able-bodied population where driving regulations is a concern. The objective of this retrospective cohort study was to assess the complication rates and complication types in adults treated for hydrocephalus with endoscopic third ventriculostomy.

Methods

All patients treated for hydrocephalus with endoscopic third ventriculostomy at Haukeland University Hospital between 1st January 2013 and 31st December 2023 were assessed for eligibility. Data on 16 types of complications was extracted from patient records and analyzed using descriptive statistics. Patients were included if they were registered with a) endoscopic third ventriculostomy, and b) a hydrocephalus-related diagnosis code, and were between 18 and 67.

Results

Out of the 129 patients treated with endoscopic third ventriculostomy in the study period, 59 were eligible for inclusion. Complications was registered in 11 out of 59 patients. Of driving-related complications, we found one case of transient visual disturbances. No other complications of relevance to driving, such as epilepsy or dizziness, was found. Additionally, all complications were transient and left no permanent morbidity.

Conclusions

Our results support previous reports suggesting that endoscopic third ventriculostomy is a safe procedure with few adverse events. Patients should therefore be informed to resume driving when they feel capable of doing so.

Reoperations in a NORspine cohort of patients operated for Degenerative Spondylolisthesis with micro-decompression alone vs decompression and instrumented fusion

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5 beste abstrakts, 24. oktober 2024, kl. 15.15 – 15.23

Background

Severe and persisting pain and disability due to lumbar spinal stenosis can be treated with a simple surgical decompression. In cases where there is slippage between the vertebras in the sagittal plane (degenerative spondylolisthesis), additional instrumental stabilisation has been recommended. Lately high-quality studies (two Scandinavian and one Japanese) indicate that this in most cases is unnecessary. However, there has been made some concerns that decompression alone might increase reoperation rates, especially at long-term. The aim of this study was to compare long-term reoperation rates after micro-decompression alone and decompression and instrumented fusion.

Methods

Patients were consecutively included in the Norwegian registry for spine surgery from 2007 thru 2015. The first reoperation was identified in an external data source, the Norwegian patient registry (NPR) thru August 2023. Details about each reoperation were obtained from electronic health records. The two treatments groups were propensity score matched 1:1, and the reoperation rate at 10-years was estimated and compared using survival analyses. According to a non-inferiority design, a margin of absolute difference in estimated reoperation rate of 12.5%-points 10 years after surgery (number needed to treat = 8) was used.

Results

The unmatched cohort include 792 patients (474 micro-decompression and 318 decompression and fusion). Of these, all 569 patients included in the propensity score matched (PSM) sample were captured and recorded in NPR. In this sample, baseline mean age was 64.7 years and 73 % were female. The estimated rate of any reoperation at 10 years follow-up was 23.4% in the micro-decompression group and 20.2% in the fusion group. The difference of 3.2 %-points (90% CI, -3.0 to 9.4 %-points) more reoperations in the micro-decompression group was within the non-inferior margin.

Conclusion

Treatment of degenerative spondylolisthesis with micro-decompression alone is as good as decompression and instrumented fusion with respect to risk for reoperation.

Outcome of resection in glioblastoma patients over 70 years old, a population-based study

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Frie foredrag 1, 24. Oktober 2024, kl. 10.22 – 10.30

Background

Age is a well-known prognostic factor in patients with glioblastoma. Older age has a linear negative impact in survival, but no definitive cut-off has been established. Initial management in glioblastoma involves maximal safe resection followed by radio and chemotherapy, however, there has been a more conservative approach in the elderly.

Methods

This retrospective study analyzed patients 70 years or older in South-Eastern Norway diagnosed for glioblastoma (IDH-wildtype) between January 2019 and December 2021. Kaplan-Meier curves were utilized to calculate median overall survival. Log-rank test was employed to compare the different groups. RANO resect classification was used to evaluate extent of resection (EOR). RANO Classes 1 and 2 (supramarginal and maximal resection) were analyzed in the same group. We divided patients by age groups, 70-74, 75-70 and 80 years or older.

Results

This study collected 363 of which 121 patients were 70 years or older. The median overall survival (mOS) was 7.9 months, compared to a mOS of 14.9 months in patients under 70 years of age. RANO class 1 and 2 had a mOS of 16.3 months, while RANO 3 5.0 months ($p<0.001$), and biopsy 4.1 months ($p<0.001$). Patients between 70-74 who achieved at least maximal resection had a mOS of 14.0 months, compared to 12.0 and 20.3 months mOS in patients 75-79 and over 80 years old, respectively. Patients that underwent biopsy or RANO resect class 3, had no difference in medial survival between age groups.

Conclusion

Despite age being a negative prognostic factor, we found that if maximal resection is achieved patients can still obtain a mOS comparable to that seen in unselected younger patients. Such surgery offers a survival advantage of around 12 months compared to subtotal resection or biopsy. Whether supramaximal resection offers an additional survival advantage in the elderly is still to be defined.

Preoperative neurological status is a better predictor for survival in glioblastoma than postoperative neurological status

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Frie foredrag 3, 25. oktober 2024, kl. 09.16 – 09.22

Background

Age, adjuvant treatment, molecular features, and extent of resection are well-established prognostic factors for patients with glioblastoma. The Neurological Assessment in Neuro-Oncology (NANO) score was designed as a tool to provide an objective clinician-reported outcome of neurological status and complements the radiological evaluation of the Response Assessment in Neuro-Oncology (RANO) criteria. Despite the generally accepted detrimental impact on prognosis associated with new neurological deficits after surgery, a comprehensive understanding of the impact of pre- and postoperative neurological status remains limited. This study explores the potential of the NANO scale to predict survival when applied immediately before and after surgery.

Methods

This retrospective study examined adult patients in South-Eastern Norway who underwent resection for IDH wildtype glioblastoma between January 2019 and December 2021. We used Kaplan Meier curve calculate median overall survival and chi-square and log rank test were used to compare groups. Neurological status was addressed with the NANO score. Changes in the NANO score were defined as worsened neurological status, when the postoperative NANO score was higher than preoperative, and as improved neurological status, when postoperative NANO score was lower than preoperative.

Results

The study included 282 patients. Median overall survival was 14.9 months. Patients with a preoperative NANO-score of 0 had a median survival of 20.4 months, compared to 14.6 months for patients scoring 1-2, and 12.2 months for patients soring 3 or more points ($p < 0.001$). Neither Postoperative NANO scores, nor worsened or improved neurological status, were found to be significant predictors for survival.

Conclusion

This study indicates that a low preoperative NANO were predictive for a longer median survival, whereas postoperative NANO scores did not show the same impact. Surprisingly, new or worsened neurological deficits, did not correlate to with a shorter median survival.

Return to Work After Surgery for Lumbar Disk Herniation - A Nationwide registry-based Study

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Frie foredrag 1, 24. oktober 2024, kl. 10.02 - 10.10

Introduction

The ability to return to work (RTW) is increasingly recognized as an essential outcome measure for spine surgery. Using two nationwide databases, we investigated the long-term patterns of sick leave among patients undergoing surgery for lumbar disk herniation to study the achievement of post-surgery RTW.

Methods

The study included 13,698 patients aged 18 to 60 on sick leave undergoing surgery for lumbar disk herniation from January 2007 through January 2019. Data from the Norwegian Registry for Spine Surgery (NORspine) and the Norwegian Labour and Welfare Administration (NAV) were linked. Certified sick leave around the time of surgery was assessed. The patients were further categorized according to the length of pre-surgery sick leave, and the rate of sustainable RTW for the different groups was compared using survival analysis. The association between successful surgical outcomes, defined by a 30% improvement in Oswestry Disability Index score, and achievement of sustainable RTW was analyzed using a logistic regression model.

Results

Two years after surgery, 76% of the patients had returned to work. Shorter pre-surgery sick leave was associated with a higher proportion and rate of achieved sustainable RTW: Among patients with sick leave of less than 30 days, a total of 99% achieved sustainable RTW (median 46 days) without relapse of sick leave over 28 days, while only 40% of patients with longer-lasting work assessment allowance achieved the same goal within two years. Successful surgical outcomes were associated with sustainable RTW for all patient groups, but the impact of surgical success on RTW declined as sick leave extended beyond 180 days.

Conclusion

Most patients had returned to work two years after lumbar disk herniation surgery. Shorter pre-surgery sick leave was associated with achieving faster and more sustainable RTW. Successful surgical outcomes had less impact on patients with extended sick leave.

Assessing Motor Cortex Stimulation for Spinal Cord Injury: A Randomized Controlled Trial

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Frie foredrag 2, 24. oktober 2024, kl. 16.25 - 16.33

Introduction
Spinal cord injury (SCI) is a profoundly debilitating event with significant life-altering implications. Emerging literature supports the potential beneficial effect of repetitive transcranial magnetic stimulation (rTMS) as a rehabilitation intervention post-SCI. This study aims to evaluate the efficacy of non-invasive motor cortex stimulation via rTMS in enhancing functional recovery.

Methods
We are enrolling 20 chronic patients with low cervical or thoracic ASIA C or D spinal cord injuries. Before treatment patients are randomized to either active or placebo stimulation. Intermittent Theta-burst stimulation (iTBS) is administered using a figure-of-eight coil. With the assistance of functional MRI-guided neuro-navigation the coil is positioned over the representative primary motor cortex region of the lower limb. Each participant undergoes 15 treatment sessions distributed over three weeks with assessments scheduled before, during, and up-to-12 weeks after treatment. Primary outcome measurements are focused on lower limb kinematics such as speed and joint. Secondary measures include assessment of spasticity, pain evaluation and self-reported autonomic function.

Results
Preliminary results reveal a potential therapeutic benefit of iTBS for spasticity in chronic SCI patients.

Conclusion
More patients need to be treated to confirm our findings. This study highlights the importance of investigating novel therapeutic approaches for SCI rehabilitation.

Are diagnoses of unruptured intracranial aneurysms associated with quality of life, psychological distress, health anxiety, or use of healthcare services in untreated individuals? A longitudinal, nested case-control study

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5 beste abstrakts, 24. oktober 2024, kl. 15.25 - 16.33

Introduction

Increasing imaging examination rates leads to a corresponding rise in the detection rates of unruptured intracranial aneurysms (UIAs). There is limited knowledge on how the detection of UIA affects health-related outcomes in untreated patients. In this study we aimed to investigate if the diagnosis of UIA is associated with psychosocial outcomes, healthcare services utilisation, or sick leave in untreated individuals?

Material and methods

Nested case-control study with 96 participants diagnosed with UIAs through magnetic resonance angiography (MRA) screening, not receiving preventive aneurysm obliteration. Comparisons were made with Control1 (192 participants with negative MRAs) and Control2 (192 individuals not MRA screened). Quality of life, psychological distress, and health anxiety were assessed using EQ-5D-5L including EQ VAS, Hopkins Symptom Checklist-10, and Whiteley Index-6, respectively. Healthcare service utilisation and sick leave were measured using register data. Median follow-up was 32–55 months for the different outcomes.

Results

UIA were in general not associated with psychosocial outcomes, neither compared to pre-screening values nor to controls. The exemption was a lower mean EQ VAS score at follow-up for cases (76.7) versus Control1 (80.0), regression coefficient −3.87 (95% CI (−7.60, −0.14). Cases had significantly higher rates of radiology exams compared to controls, with 1.47 (95% CI 1.25, 1.74) exams per person-year versus 0.91 (C95% CI 0.75, 1.09) for Control1 and 0.95 (95% CI CI 0.79, 1.14) for Control2. No significant differences were observed in other psychosocial outcomes, healthcare services utilisation, or sick-leave.

Discussion and conclusions

The overall impact of untreated UIAs appears to be limited when assessed years after diagnosis.

The value of intraoperative CT in stereotactic EEG surgery

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Frie foredrag 4, 25. oktober 2024, kl. 11.15 – 11.21

Background
Approximately one-third of patients with drug resistant epilepsy undergo diagnostic intracranial electroencephalography (EEG). In recent years, stereo-EEG emerged as a minimally invasive surgical procedure which involves the placement of depth electrodes into the brain tissue with aim to define a putative epileptogenic zone. Due to its minimal invasiveness, stereo-EEG is well-tolerated and carries a low risk of morbidity and mortality. To avoid potential serious adverse events, the accuracy of electrode placement is crucial. The aim of this study was to assess whether the use of intraoperative CT for registration purpose improved the accuracy of electrode placement.

Methods
Surgical candidates who underwent stereo-EEG between 2015 and 2023 were prospectively registered. Patients were dichotomized according to utilized registration modality into: (i) surface matching with soft-touch, and (ii) auto-registration with intraoperative CT. Preoperative trajectory plans, and postoperative electrode position measurements were assessed in iPlan (Brainlab) after fusion of pre- and postoperative images. Quantitative analysis of accuracy error between planned and implanted electrodes was assessed using equation for Euclidean distance (√((X1-X2)^2+(Y1-Y2)^2+(Z1-Z2)^2)) at entry point (EP), measured at the level of dura, and target point (TP), defined as the deepest visible artifact of the electrode.

Results
From 2015 to 2023, 130 patients underwent stereo-EEG surgery at our department. We analyzed the accuracy of 416 electrodes in 42 (32%) patients operated using surface-matching, and of 352 electrodes in 28 (22%) patients operated using auto-registration with intraoperative CT. The mean EP error was 1.56 ± 0.95 mm vs. 0.98 ±0.65 mm, and the mean TP error was 1.96 ± 1.39 mm vs 1.53 ±1.33 mm for surface-matching and auto-registration, respectively ($p<0.0001$).

Conclusions
Use of intraoperative CT imaging as a tool for patient registration in stereo-EEG surgery showed higher accuracy in electrode placement, thus, potentially reducing the risk of serious hemorrhagic adverse events in these patients.

Supramaximal resection can improve overall survival in patients with MGMT-unmethylated glioblastoma

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Frie foredrag 3, 25. Oktober 2024, kl. 09.24 – 09.30

Introduction
Glioblastoma is highly resistant to surgery, radio- and chemotherapy. Its heterogeneity is a therapeutic challenge. O6-methylguanine–DNA methyltransferase (MGMT) promotor methylation is an established biomarker for favorable response to chemotherapy. Supramaximal resection has been demonstrated to improve overall survival (OS), but whether this benefit applies equally to patients with different MGMT-promotor methylation status is still to be debated.

Material and Methods
Population based retrospective study that examined all adult patients in South-Eastern Norway that underwent resection for IDH wildtype glioblastoma between January 2019 and December 2021. Extent of resection (EOR) was classified according to RANO resect classification and MGMT-promotor methylation status by pyrosequencing-qPCR.

Results
The study included 282 patients. MGMT-promotor methylated patients (MGMT+) had a median OS of 18.4 months compared to 13.1 months in MGMT-unmethylated (MGMT-) patients ($p<0.0001$). Patients with supramaximal resection had a median OS of 20.4 months compared to 14.9 months ($p<0.01$) with maximal resection. For patients with supramaximal resection, we found no significant difference in median OS (25.5 vs. 18.3 months ($p=0.24$)) dependent on MGMT-status. Separated analysis between MGMT-status and EOR showed a median survival of 18.3, 13.1 ($p<0.001$), and 8.3 ($p<0.001$) months for MGMT-, and 26.7, 18.4 ($p=.99$), and 9.0 ($p<0.001$) months for MGMT+ in patients where supramaximal-, maximal-, and submaximal resection was achieved, respectively.

Conclusions
Patients with supramaximal resection and MGMT+ have a 50% 2-years survival probability. In patients where supramaximal resection was achieved, survival benefit was not dependent on MGMT-status. There was a significant improved survival in MGMT- patients between supramaximal and maximal resection, that was not present for MGMT+ patients. Intraoperative molecular diagnosis has the potential to guide the surgical strategy dependent on MGMT-promotor methylation status, especially in tumors where supramaximal resection has a higher risk of new neurological deficits.

Outcome After Surgical Treatment of Spinal Synovial Cysts

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Frie foredrag 3, 25. oktober 2024, kl. 09.40 – 09.46

Background
Surgical treatment of degenerative spinal disorders is generally safe and successful. Improved radiological capabilities has led to increased discovery of spinal synovial cysts. These are benign lesions, but can cause substantial morbidity. Treatment is controversial, with recommendations varying from conservative to surgical options. The result after surgical treatment is inadequately studied. The purpose of the study was to analyze the outcome after surgical treatment of the cysts.

Materials and methods
The study is a retrospective analysis of data collected into the Norwegian Registry for Spine Surgery from 2007 to 2020. We included patients that were treated surgically for spinal synovial cysts. We excluded patients with additional diagnoses such as spinal stenosis and disc herniation. We collected surgeon- and patient-reported data at baseline, and patient-reported outcome after 12 month follow-up. The primary aim was disability after surgery, measured with Oswestry Disability Index. Secondary outcomes were leg and back pain, health related quality of life, patient-evaluated benefits, and surgical complications.

Results
A total of 473 patients were included at baseline. At 12 month follow-up, 315 (67 %) patients remained for analysis. The patients had a mean decrease in Oswestry Disability Index of 31.2 points (71% [95 % CI, 29.3-33.1]). 222 (70.5%) of the patients achieved a predefined patient acceptable symptom state. Back and leg pain decreased from mean 6.5 to 2.8 (57%) and 6.6 to 2.2 (67%), respectively. 8 (3%) patients experienced dural tear as perioperative complication.

Conclusion
Surgical treatment of spinal synovial cysts shows good outcomes with few complications. Patients report minimal disability, and decrease of both back and leg pain. Surgical treatment of the cysts is considered safe and useful.

Langtidsresultater etter kirurgi for degenerativ cervical myelopati / Long-term results after surgery for degenrative cervical myelopathy

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5 beste abstrakts, 24. oktober 2024, kl. 15.35 - 15.43

Background
Surgical treatment for degenerative cervical myelopathy (DCM) is considered safe and effective. Long-term surgical results are limited. Long-term clinical outcomes were studied through data from the Norwegian registry for spine surgery.

Methods
Patients who were operated at the university hospitals serving Northern and Central Norway were approached after 3 to 8 years and asked to provide data for long-term follow-up. Outcomes were changes in the Neck Disability Index, the European Myelopathy Scale score, quality of life (EuroQoL EQ-5D), numeric rating scales (NRS) for headache, neck pain, and arm pain, and perceived benefit of surgery assessed by the Global Perceived Effect scale from 1 year to long-term follow-up.

Results
144 patients operated between January 2013 and June 2018 were included. 123 participants (85.4%) provided patient-reported outcome measures (PROMs) at long-term follow-up. The changes in PROMs from 1 year to long-term follow-up were not significant, including Neck Disability Index (mean change 1.0, 95% CI -2.1-4.1, P = .53), European Myelopathy Scale score (mean change -0.3, 95% CI -0.7-0.1, P = .09), EQ-5D index score (mean change -0.02, 95% CI -0.09-0.05, P = .51), NRS neck pain (mean change 0.3 95% CI -0.2-0.9, P = .22), NRS arm pain (mean change -0.1, 95% CI -0.8-0.5, P = .70), and NRS headache (mean change 0.4, 95% CI -0.1-0.9, P = .11). According to Global Perceived Effect assessments, 106/121 patients (87.6%) reported to be stable or improved ("complete recovery," "much better," "slightly better," or "unchanged") at long-term follow-up compared with 88.1% at 1 year.

Conclusion
Patients undergoing surgery for DCM demonstrates persistence of statistically significant and clinically meaningful improvement across a wide range of PROMs at long-term follow-up.

Radiation-induced cavernous malformations: A case report and literature review

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Frie foredrag 3, 25. oktober 2024, kl. 09.32 – 09.38

Introduction
Radiation-induced cavernous malformations (RICMs) are usually observed in the aftermath of high-dose conventional radiotherapy and are rarely seen after stereotactic radiosurgery. The most frequent primary cancers associated with RICMs are medulloblastoma and leukemia in children. The majority of RICMs occur in the cerebrum, and there are few reports on such lesions in the brainstem.

Materials and Methods
We examined a patient with vestibular schwannoma who underwent treatment with Gamma Knife and subsequently developed a cavernous malformation in the brainstem. Additionally, we conducted a literature review on RICMs.

Results
The patient, a woman in her fifties, had a vestibular schwannoma measuring approximately 2 cm^3, treated with a marginal dose of 12 Gy in 2005. She was followed for many years, with her most recent MRI conducted in 2019. Over time, the vestibular schwannoma decreased in size and she was clinically stable. In 2024, she started experiencing an increasing tendency to fall and episodes of dizziness, which prompted a new MRI. This scan revealed a lesion in the pons adjacent to the previously irradiated tumor. The lesion was radiologically suggestive of a cavernous malformation. Given the patient's age, the lesion's location, and the relatively low risk of hemorrhage, a conservative treatment approach was recommended.

Conclusion
We present a case of a brainstem RICM occurring 19 years after Gamma Knife treatment of a vestibular schwannoma, and a review of RICMs, particularly those associated with stereotactic radiosurgery.

Ultrasonographic assessment of optic nerve sheath diameter as a screening tool for intracranial hypertension in traumatic brain injury

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Frie foredrag 4, 25. oktober 2024, kl. 11.39 - 11.45

Background
Severe traumatic brain injury (TBI) is a condition burdened by high morbidity and mortality. Prevention of secondary insults is one of the main goals of management and intracranial pressure monitoring is a cornerstone in management of TBI. The relationship between intracranial pressure and optic nerve sheath is known from the literature. Optic nerve sheath ultrasonography could represent a method added to our armamentarium for monitoring intracranial pressure.

Methods
We investigated how ultrasound-measured optic nerve sheath diameter varies as a function of intracranial pressure in a cohort of patients with severe blunt head injury in whom an intraparenchymal sensor was placed. We evaluated the accuracy of optic nerve sheet diameter (ONSD) in distinguishing dichotomized ICP cut-offs and analyzed the learning curve and its potential as screening tool to select TBI patients most in need of invasive ICP monitoring in a setting with constraints on resources.

Results
ONSD and ICP have a linear relationship. Nevertheless, there are limits of evaluating the one-to-one correspondence between those two variables. We selected a cut-off of sonographic ONSD above which there is a concernable elevation of intracranial pressure worthy of invasive second line invasive monitoring. Thus, it is possible to use ONSD as a first line non-invasive tool to intercept patients at risk of developing frank intracranial hypertension in a hypotetical scenario of low resources settings.

Conclusions
We propose the use of ONSD ultrasound as a screening investigation for post-traumatic intracranial hypertension in the context of an emergency department, especially in contexts where there is limited availability of intracranial pressure monitors.

Reducing e-scooter rental availability reduces the number of traumatic brain injuries.

August Vincent Berglihn Stray, Mats Døving, Eirik Helseth, **Jon Ramm-pettersen**[1]
[1]Ous

Frie foredrag 4, 25. oktober 2024, kl. 11.47 - 11.56

Introduction
The rise in popularity of electric scooters (e-scooters) as an urban transport option has raised concerns about rider safety. To address these concerns, our research group conducted a cohort study examining e-scooter injuries over a one-year period (2019-2020). Our findings indicate that e-scooter injuries are more likely to occur at night and involve young, intoxicated adults. Additionally, riders are frequently prone to traumatic brain injuries (TBI) and seldom wear helmets.

Methods
This study investigates TBIs resulting from e-scooter accidents admitted to the Department of Neurosurgery at Oslo University Hospital, a level 1 trauma center. Data were collected from September 2020 to August 2022, comparing the year before and after regulations were introduced on September 1, 2021.

Results
During the study period, 57 patients with TBI from e-scooter accidents were admitted to the neurosurgical department. The number of TBIs decreased from 38 to 19 after the introduction of regulations (p=0.01). The severity of TBI, measured using the Head Injury Severity Score (HISS) and Rotterdam score, remained consistent across both periods. Head injuries with concurrent facial injuries decreased from 18 to 10 (p=0.14). The percentage of intoxicated riders at the time of injury showed a decreasing trend, though not statistically significant (60.5% vs. 52.6%, p=0.569).

Conclusion
Our study indicates that regulating e-scooter availability and nighttime usage significantly reduces the total number of TBIs, particularly during nighttime. However, injuries continue to occur frequently in the evening, and a majority of riders remain intoxicated.

The impact of authors' medical specialty on publication patterns and published results of adjuvant radiotherapy for WHO grade 2 meningiomas

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5 beste abstrakts, 24. oktober 2024, kl. 15.45 – 15.53

Introduction
The role of adjuvant radiotherapy after gross total resection (GTR) of WHO grade 2 meningioma remains unclear. We hypothesized that authors' medical specialties could be associated with reported findings on the role of adjuvant radiotherapy after GTR of WHO grade 2 meningiomas.

Methods
A systematic review was conducted in Embase and Medline databases, in addition to screening of all relevant bibliographies. The search was conducted with assistance from an experienced librarian Articles including patients aged 18 years or older, with histologically confirmed WHO grade 2 meningioma, were included. GTR was defined as Simpsons grade 1-3. Data on medical subspecialties was extracted using the author list. We registered study design, median follow-up, number of included patients, WHO classification in use, and years of study inclusion.

Results
Thirty-seven relevant studies between 1990 and 2021 were identified. Of those, 34 (92%) were retrospective cohort studies, two studies (5%) were systematic reviews, and one study (3%) was a meta-analysis. If the last author was a radiation-oncologist, the study was more likely to favour adjuvant radiotherapy, and if a neurosurgeon was last author, the study was more likely to not advocate adjuvant radiotherapy (p=0.009). There was no significant association between study result and whether the study was published in a neurosurgical or oncological journal (p=0.802). There was no significant difference in follow-up time, years of inclusion, or number of included patients between studies favouring or not favouring adjuvant radiotherapy.

Conclusions
In this systematic review of the literature, we found that if a radiation-oncologist was the last author of the study, the study was more likely to favour adjuvant radiotherapy GTR of WHO grade 2 meningioma. Clinicians and researchers should be aware of a possible genealogy bias in the neuro-oncological literature

Regional differences in survival of glioblastoma patients in Norway, 2019–2023: a nationwide registry-based cohort study

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5 beste abstrakts, 24. oktober 2024, kl. 15.55 - 16.03

Background

The Norwegian Brain and Spinal Cord Tumour Registry has documented that survival for adults with histologically verified glioblastoma is lower in North-Norway compared to other regions. This study aimed to investigate potential epidemiological or prognostic factors that might explain these differences.

Methods

We used the Cancer Registry of Norway and identified 1225 patients aged 18–89 years with histologically verified glioblastoma who underwent surgery (biopsy or resection) between 2019–2023. Surgical treatment intensity was defined as the incidence of surgically treated patients per 100,000 inhabitants per region. Poisson models adjusted for age, sex and year were used for comparisons. Full treatment was defined as resection plus combined chemoradiotherapy. We estimated median survival and used flexible parametric models to compare patient excess mortality, comparing observed and expected mortality per region matched by age, sex, year and residential health trust. The Norwegian average was the reference for all rate ratios.

Results

For patients aged 18–70 years, there were no statistically significant regional differences in incidence or patient survival. In patients over 70 years, North-Norway had a higher incidence of surgical procedures than the national average (incidence rate ratio 1.35; 95% CI:1.01–1.78), a smaller proportion treated with resection and short-course radiation plus temozolomide (22% vs. 36-51%) and more patients undergoing biopsy without further oncological treatment (15% vs. 0-6%). For patients aged 76-89 years, median survival was 3.6 months in North-Norway versus 6.4–8.0 months in the other regions, and excess mortality was significantly higher than the national average after adjustment for age, sex and year (excess mortality ratio: 1.77; 95% CI:1.18–2.51), though not after further adjustment for oncological treatment.

Conclusion

The lower survival of patients in North-Norway is likely due to a practice variation consisting of a lower threshold for selection of elderly patients for invasive procedures.

Stable glioma incidence and increased patient survival over the past two decades in Norway

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Frie foredrag 3, 25. oktober 2024, 09.08 – 09.14

Background
Monitoring the incidence and survival of gliomas is essential for understanding disease burden and optimizing healthcare resource allocation. This study aimed to describe the trends in glioma incidence and patient survival in the Norway population over the past two decades.

Methods
This nationwide registry-based cohort study included 7048 patients with histologically confirmed gliomas reported to the Cancer Registry of Norway from 2002 to 2021. Age-standardized incidence rates (ASIR) per 100,000 person-years and age-standardized relative survival (RS) were calculated. The study stratified data by histopathology group, age, and sex. Patients were followed from diagnosis until death, emigration, or December 31, 2022.

Results
The ASIR for gliomas was 7.4 per 100,000 person-years, with glioblastoma being the most frequent subtype. Males had a higher incidence rate (8.8 per 100,000) compared to females (6.1 per 100,000). The overall incidence of gliomas remained stable over the study period. The 1-year and 5-year RS were 63.6% and 32.8%, respectively, with a slight survival advantage observed in females. Survival improved over time for most glioma subtypes, with the 5-year RS for glioblastoma increasing from 5.4% in 2006 to 10.0% in 2021.

Conclusions
Over the past 20 years, the incidence of gliomas in Norway has remained stable, while patient survival has improved.

Validation of robot-assisted stereo-EEG surgery accuracy using anthropomorphic skull phantom - preliminary results

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Frie foredrag 4, 25. oktober 2024, kl. 11.23 – 11.29

Background and aims
Stereo-EEG is a minimally invasive procedure that comprises high-precision placement of depth electrodes within the brain. For this purpose were used either frame-based or frameless stereotactic techniques. In the past two decades, several robotic systems became available. We aimed to verify accuracy of a novel robot-arm on an anthropomorphic skull phantom. The primary and secondary objectives were accuracy and stylet implantation time.

Material and methods
Based on patient-specific radiologic images, we 3D-printed a silicon-coated skull phantom. To mimic brain, it was filled with 1450 mL gelatin. The patient data were anonymized and transferred to a navigation system. We created a plan of 540 trajectories, 270 for each side, subdivided in 9 head regions à 30 trajectories.
After phantom registration with intraoperative CT-scan, we performed a robot-assisted placement of 9 stylets in each hemisphere. Control CT-scan was acquired and quantitative analysis of error (in mm) between planned trajectory and implanted stylet was assessed using Euclidean distance equation ($\sqrt{((X_1-X_2)^2+(Y_1-Y_2)^2+(Z_1-Z_2)^2}$). The entry point (EP) was measured at tabula interna, and target point (TP) at the deepest visible stylet artefact on postoperative CT-scan. These results were compared with our clinical data on 352 implanted electrodes using Varioguide and CT-autoregistration.

Results
The results on accuracy of 108 stylets were available for analysis. The mean EP-error was 1.1±0.73 mm, and the mean TP-error was 1.42±0.9 mm. There was no difference in accuracy compared with results from the clinical study (EP-error 0.98±0.65 mm, p=0.104; and TP-error 1.53±1.33 mm, p=0.422; t-test). Furthermore, the mean stylet implantation time was 03:14 min.

Conclusions
The precision of robot-arm in stereo-EEG surgery on a phantom did not differ from the precision observed in a clinical practice using Varioguide and CT-autoregistration. The mean implantation time per stylet was shortened. These results support the use of robot-arm for stereo-EEG surgery.

Optimalisering av pasientseleksjon ved hjelp av big data fra NORspine

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Frie foredrag 4, 25. oktober 2024, kl. 11.31 - 11.37

In anterior cervical discectomy for radicular pathologies, the surgical method is rather uniform, yet results differ significantly between hospitals and both public and private care providers. The Norwegian Registry for Spine Surgery (NORspine) prospectively collects data for a majority of degenerative spine surgeries performed. Previous studies have shown that certain socieodemographic and medical risk factors are associated with negative outcome after anterior cervical discectomy and fusion (ACDF). Prediction models for non-success 12 months after ACDF for cervical radiculopathy were built by logistic regression modelling. Non-successful outcomes were defined as Neck Disability Index (NDI) improvement less than 30%, NDI raw score of 26 or more, or a Numeric Rating Scale (NRS) arm score of 3 or more. Probabilities from the regression models were utilized to adjust reported outcomes based on case mix differences and to look at outcome differences after case mix adjustments. Headache intensity, duration of arm pain, litigation, previous cervical surgery, surgery on more than one cervical level, mother language, anxiety or depression, smoking, educational level, hard physical work, age, diabetes type II, duration of paresis and baseline NDI and NRS arm pain were all significant predictors for non-successful outcomes. Exclusion of high-risk patients led to significant improvement in outcomes, however the results differed between units. Case mix was most favorable in private institutions. Data from NORspine could lead to better outcomes after ACDF for cervical radiculopathy, both by adressing modifiable risk factors, patient education and by excluding patients with a negative risk profile with high chance for non-success.

Drug resistant glioma stem cell cultures exhibit enriched stemness signatures and share extracellular matrix overexpression

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Frie foredrag 3, 25. oktober 2024, kl. 09.00 – 09.06

Glioblastoma (GBM) is the most common and aggressive primary brain tumor in adults. The heterogeneity of GBM, alongside their resistance to chemotherapy and irradiation poses challenges in developing interventions. Current evidence indicates that glioma stem cells (GSCs), a GBM cell population with stem cell-like properties, underpin drug resistance and relapse in GBM.

Patient-derived GSC cultures established from GBM biopsies preserve the parental tumor's tumorigenicity and cellular traits, providing an individualized tumor model. Our recent findings from drug screening >30 GSC cultures against >500 drugs identified substantial heterogeneity in drug sensitivity profiles, allowing characterization into drug-sensitive and drug-resistant phenotypes. The study's aim was to characterize drug resistance by comparing drug-sensitive (n=4) and drug-resistant (n=5) GSC cultures. Their differentiation capacities and stemness profiles were explored. Differences in proliferation, whole-genome methylation patterns and gene expression were also evaluated.

Our results indicate that drug-resistant GSCs exhibit more enhanced stemness characteristics compared to drug-sensitive GSCs, reflected by higher gene expression of key stemness markers. Drug-resistant GSCs also showed sustained protein levels of various stemness markers post-differentiation, particularly OLIG2 and SOX2, in contrast to decreased levels in drug-sensitive GSCs, suggesting a tendency to maintain stemness. Drug-resistant GSCs also exhibited lower astrocyte and neuronal differentiation capacities than drug-sensitive GSCs. Full genome expression analysis revealed significant enrichment and overexpression of collagen and extracellular matrix (ECM)-associated genes in drug-resistant GSCs, alongside ABC drug pump upregulation. Finally, comparison of genome-wide methylation patterns showed CpG islands regulating genes associated with axonogenesis and cell leading edge to be most differentially methylated between the two groups.

In summary, our results indicate that drug-resistant GSCs exhibit individualized but overall enhanced stemness profiles, with gene expression and methylation profiles linked to greater ECM deposition and axonogenesis. Our data highlight the role of GSCs in GBM drug resistance and unveil molecular mechanisms potentially underlying this resistance.

Treatment, specialized rehabilitation, and mortality in different age groups of a Norwegian cohort of older adults with moderate and severe traumatic brain injury.

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Frie foredrag 3, 25. oktober 2024, kl. 09.48 – 09.56

Background
Traumatic brain injury (TBI) is a major cause of death and disability globally and poses large challenges in health care.
The purpose of the study was to explore treatment, rehabilitation and mortality in different age groups of older adults with moderate and severe TBI during a 17-year period at a regional trauma center in Norway.

Methods
This study was an observational cohort study where all patients ≥ 16 years admitted from 01.10.2004-01.10.2021 to St.Olav University Hospital with a moderate TBI (Glasgow Coma Scale [GCS] score 9-13) or severe TBI (GCS score 3-8) were prospectively included. Cause of injury was registered as road traffic accident, fall, assault, gunshot and other. Neurosurgical intervention was defined as intracranial pressure measurement with or without ventricular drainage and evacuation of hematoma. ICU-stay and discharge destination were recorded. Mortality was registered at discharge, at 6- and 12 months post-injury.

Results
A total of 795 patients were included, 47% with moderate and 53% with severe TBI. Fall was the dominating cause of injury in patients >60 years. Neurosurgical intervention was performed in 30% of patients with moderate and 68% of patients with severe TBI. Only 14% of patients ≥ 80 years received surgery. None of the patients ≥ 90 received neurosurgical intervention. In severe TBI there was a decline in surgical intervention from the decades ≥ 60 years.
Ninety-four % of all patients received ICU-care, 75% in patients over 80 years. Seven patients aged 70-80 years and two patients ≥ 80 years were discharged to rehabilitation facilities. Mortality at discharge, 6 months and 12 months were 19%, 25% and 28%, respectively.

Conclusion
In this prospective cohort of moderate and severe TBI, we found that neurosurgical interventions and discharge to specialized rehabilitation facilities were less likely in patients with severe TBI and ≥ 70 years old.

NORSK NEVROKIRURGISK FORENING