

ORIGINAL RESEARCH

Outcome of Aneurysmal Subarachnoid Hemorrhage in a Population-Based Cohort: Retrospective Registry Study

Mathilde V. Iversen, MS; Tor Ingebrigtsen, MD, PhD ; Jon A. Totland, MD; Roar Kloster, MD; Jorgen G. Isaksen, MD, PhD

BACKGROUND: Studies of aneurysmal subarachnoid hemorrhage report an association between higher patient volumes and better outcomes. In regions with dispersed settlement, this must be balanced against the advantages with shorter prehospital transport times and timely access. The aim of this study is to report outcome for unselected aneurysmal subarachnoid hemorrhage cases from a well-defined rural population treated in a low-volume neurosurgical center.

METHODS: This is a retrospective, population-based, observational cohort study from northern Norway (population 486 450). The University Hospital of North Norway provides the only neurosurgical service. We retrieved data for all aneurysmal subarachnoid hemorrhage cases (n=332) admitted during 2007 through 2019 from an institution-specific register. The outcome measures were mortality rates and functional status assessed with the modified Rankin scale.

RESULTS: The mean annual number of cases was 26 (range, 16–36) and the mean crude incidence rate 5.4 per 100 000 person-years. Two hundred seventy-nine of 332 (84%) cases underwent aneurysm repair, 158 (47.5%) with endovascular techniques and 121 (36.4%) with microsurgical clipping, while 53 (15.9%) did not. The overall mortality rate was 16.0% at discharge and 23.8% at 12 months. The proportion with a favorable outcome (modified Rankin scale scores 0–2) was 36.1% at discharge and 51.5% at 12 months. In subgroup analysis of cases who underwent aneurysm repair, the mortality rate was 4.7% at discharge and 11.8% at 12 months, and the proportion with a favorable outcome 42.3% at discharge and 59.0% at 12 months.

CONCLUSIONS: We report satisfactory outcomes after treatment of aneurysmal subarachnoid hemorrhage in a low-volume neurosurgical department serving a rural population. This indicates a reasonable balance between timely access to treatment and hospital case volume.

Cerebrovascular disease is the fourth most prevalent cause of lost life years in the Norwegian population,¹ and aneurysmal subarachnoid hemorrhage (aSAH) contributes disproportionately because it strikes relatively young patients and has a high case fatality rate. The incidence is estimated to 9 per 100 000 person-years.²

Nieuwkamp et al³ reviewed and performed a meta-analysis of outcomes in population-based prospective cohorts published between 1973 and 2002. Few sub-

sequent studies have reported long-term outcomes in such unselected cohorts.^{4–6} The nationwide Swiss SOS (Swiss Study on Subarachnoid Hemorrhage) and the Danish Stroke registry have registered aSAH cases prospectively since 2009 and 2017, respectively.^{5,7}

An association between high patient volumes and better outcomes has been established for the management of aSAH.^{8,9} In regions with dispersed rural populations, this must be balanced against the advantages with shorter prehospital transport times and

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Supplementary Material for this article is available at <https://www.ahajournals.org/doi/suppl/10.1161/SVNL.121.000148>

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Aneurysmal Subarachnoid Hemorrhage Report Of The Cooperative Study

Harold P. Adams, Adolph L. Sahs



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Aneurysmal Subarachnoid Hemorrhage Adolph L. Sahs,1981 *Neurosurgical Management of Aneurysmal Subarachnoid Haemorrhage* I.A. Langmoen, Tryggve Lundar, Rune Aaslid, Hans-J. Reulen, 1999-04-19 The small neck of the aneurysm afforded an easy surgical attack An ordinary flat silver clip was placed over the sac and tightly compressed obliterated it completely The clip was flush with the wall of the carotid artery The sac lateral to the silver clip was then picked up with the forceps and thrombosed by the electrocautery Walter Dandy reporting his successful operation of a posterior communicating aneurysm on March 23 1937 Walter Dandy s patient left the hospital in good health 2 weeks later and from his report one may gain the impression that the operation was an easy task Despite continuous developments during the following decades it was not until the introduction of the operating microscope and microsurgical techniques that surgical treatment was generally accepted During the microsurgical era surgical results have continued to improve due to diagnostical neuroanaesthesiological and microsurgical refinements and improved neurointensive care Endovascular obliteration has become an important treatment alternative but this has not been included in this particular volume The purpose of the present supplement of the ACTA NEUROCHIRURGICA is to review some of the elements in the neurosurgical management of patients with aneurysmal subarachnoid haemorrhage that are important for a successful outcome Professor Helge Nornes has been a major force in the development of new techniques and research strategies in this area for a number of years and has recently retired from the National Hospital in Oslo **Neurological Disorders** Thomas Brandt, 2003-01-03 This single volume reference covers the natural course treatment and management of all neurological diseases affecting the brain spinal cord nerves and muscles This comprehensive text reference seeks to assist physicians with treatment by providing an easy to use compendium covering the treatment and management of all neurological diseases along with details on the natural course of these diseases Organized for ease of use and quick reference each chapter presents a neurological disorder or key symptoms and systematically discusses the clinical syndrome and differential diagnosis natural course principles of therapy and practical management of each Covers wide range of neurological conditions and potential treatments including the evidence for and against each treatment Describes the spontaneous course of neurological diseases along with discussion of the management of different stages and variants of a disorder Presents special situations and exceptional cases in which alternative therapies should be considered Cerebral Vascular Disease ,1981 **Rosen's Emergency Medicine** John A. Marx, Robert S. Hockberger, Ron M. Walls, James Adams, 2006 This completely revised edition continues to serve as the definitive resource Now with a new full color page layout and many full color illustrations it encompasses all of today s scientific and clinical knowledge with a focus on the diagnosis and management of the problems most frequently encountered in the emergency department Comprehensive in scope and featuring a templated user friendly organization it remains a valuable reference *Yonago acta medica* ,1997 **Neurologia Medico-chirurgica** ,2007

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