Telemedicine, remote care of patients aided by internet- or telephone-based telecommunication technology, has been developed to overcome barriers to providing services, especially for patients needing time-sensitive specialty care in rural or medical-shortage areas requiring long-distance travel.

Telemedicine Benefits in Routine Postsurgical Follow-Up Care

Telemedicine as used in postoperative follow-up care commonly relies on nonsurgeon medical and/or allied health professionals (e.g., nurse practitioners). When used for routine postsurgical follow-up care, telemedicine strategies offer the potential to narrow access to care and cost disparities during a critical time period when most complications occur, and telemedicine may also reduce gaps and frustrations that can negatively impact a patient’s clinical outcomes and quality of life.

Employing available telemedicine technologies is a strategy that can bridge care gaps and improve access to needed services for patients who can be cared for without their having to return to a regional specialty center. Local clinics, patient homes, and facilities with appropriate telemedicine technology can be used during the postoperative period for 3 general purposes: for follow-up visits that replace those scheduled at distant sites, ongoing monitoring, and the remote identification of complications. Relatively brief, structured telemedicine visits for some post-neurosurgical follow-up care can reduce the time and travel costs to patients and their families, and they can reduce stress.

Systematic review evidence of telemedicine intervention outcomes for postsurgical follow-up care comes from 21 mostly small US studies subject to selection bias in diverse low-risk surgery patients published between 2010 and July 2015. For the included studies that reported the following outcomes, the majority of patients were willing to use telemedicine, and there was high patient and provider satisfaction, and universal and significant savings in round-trip travel distance, time, and costs. Potential health care system benefits were also noted based on a single telephone follow-up study within the VA system in terms of cost savings, freed clinic time for new patients, and reduced wait times in specialty care with long surgery wait times. Although this evidence is not based on representative patient populations, many of the benefits of telemedicine for postsurgical patients treated by other specialties may also apply to neurosurgery.

Telemedicine Evidence for Neurosurgery Follow-Up Care

Thus far there has been little neurosurgery-specific evidence. Only two single-center studies have been published and they focused on telemedicine follow-up care of patients who have undergone elective neurosurgery. In terms of telemedicine, the results of these studies support its feasibility, safety, and effectiveness as well as patient acceptance, satisfaction, and convenience, largely related to decreased travel burden.

The most recent is a 2016 US pilot study in an urban setting (University of California, Los Angeles) of elective neurosurgery patients for selected procedures conducive to remote history and visual examination. The telemedicine intervention was a real-time videoconference conducted by an allied health professional for follow-up care during the first 90 days after patients underwent surgery; the professional used a standardized template focused on key clinical questions to identify patients’ complications, to perform a functional status evaluation, and to provide...
education regarding signs and symptoms warranting in-
person emergency room or clinic visits. Videoconfer-
ences were completed with 47 patients from home using
required equipment: mobile phone, tablet, or laptop com-
puter with a video camera. The results demonstrated high
patient acceptance and satisfaction and no difference in
emergency room visits, readmission rates at 30 and 90
days, and common symptoms reported when telemedicine
patients were compared to 42 patients with in-person post-
operative clinic follow-up visits.

The other study reported on the use of telemedicine
for postoperative routine follow-up and semi-emergent
conditions of neurosurgery patients from a tertiary care
medical center in Bangalore, India. The majority of the
study population lives below the poverty line and has to
travel long distances to the center’s outpatient clinic.
The telemedicine specialist center in Bangalore provides
real-time postoperative videoconferencing services for mostly
routine follow-up care (58% cranial and 42% spinal pa-
thologies) to two nodal centers located in the Indian cities
of Barrackpore, West Bengal, and Bhubaneshwar, Odisha.
This descriptive study retrospectively analyzed clinical
data from more than 1500 patients with over 3000 tele-
consultations during a 6-year period beginning in 2007.
Based on their results, the authors concluded that video-
conferencing for neurosurgical procedure follow-up care
was efficient, safe, and cost-effective in an environment
with significant resource constraints.

New Neurosurgery Telemedicine Follow-Up Care
Cost-Effectiveness Study

A new study by Thakar and colleagues in the present
issue is an important contribution as the first cost-effective-
ness analysis of a telemedicine intervention in the follow-
up care of patients who have undergone a neurosurgical
procedure. Their study applied a novel decision-analytic
and effectiveness measurement strategy retrospectively to
1200 consecutive patients from West Bengal, India, who
underwent elective cranial and spinal neurosurgery dur-
ing a 52-month period beginning January 1, 2013. This
study used the same Bangalore, India, specialty center and
telemedicine nodal center in Barrackpore, West Bengal,
as the previously referenced study. Patients had their first
postoperative in-person follow-up visit within 2 weeks of
their surgery, and they were then advised to have their next
follow-up visit at the teledicine nodal center between
3 and 12 months postsurgery. The follow-up teleconsul-
tation intervention was a targeted neurological examina-
tion conducted by a trained local physician, followed by
a Skype teleconference, which included a high-resolution
image transmission, with a neurosurgeon located at the
specialty center.

Thakar and colleagues’ decision analysis model com-
pares two follow-up postoperative outpatient consultation
options: real-time interactive teleconsultation from the
nodal center and routine in-person care at the more dis-
tant outpatient specialty center that required 2-day train
travel and a hotel stay for the patient and an attendant.
Patient outcomes in terms of the medical benefit value are
assumed to be identical for a successful teleconsultation
and in-person specialty center consultation since both rely
on the same neurosurgeon consultants, preventing use of
the conventional quality-adjusted life-year (QALY) utility
measure as an effectiveness outcome. Instead, effective-
ness was measured by a utility preference score using a
value scale of 0 to 1 for ease of access, quality of care, and
overall experience. This score was applied to 4 consulta-
tion scenarios: 1) “successful” teleconsultation at nodal
center (0.9); 2) patient chooses in-person consultation at
specialty center (0.8); 3) “unsuccessful” teleconsultation
requiring specialty center visit for additional evaluation
and/or treatment services (0.6); and 4) “unsuccessful”
teleconsultation requiring a local visit for additional non-
neurosurgical care (0.4). A societal perspective for the
analysis included direct and indirect costs incurred by the
health system and patients, including potential lost earn-
ings and the cost of having an attendant accompany the
patient for all visits and, when visiting the specialty center,
their travel, meals, and hotel lodging.

The result was that not only was teleconsultation cost-
effective but it was also a cost-saving alternative (i.e., low-
er cost and higher effectiveness). Cost-effectiveness for
teleconsultation versus in-person specialty care was mea-
sured by an incremental cost-effectiveness ratio (ICER);
the difference in cost was divided by the difference in
effectiveness at base case values. Teleconsultation had a
substantially lower per episode cost (42.7% of in-person
specialty care) with 97% efficiency or successful visit rate
(i.e., care needs met without another visit required) yield-
ing a higher overall utility (effectiveness) of 0.89 compared
to 0.80 for in-person specialty care. Sensitivity analysis
indicated threshold values at which teleconsultation would
no longer be more cost-effective than in-person specialty
consultation. The threshold values for the two most influ-
ential variables were 44% for the successful visit rate and
0.34 for the teleconsultation utility value, which hardly
seem plausible compared to the study’s well-supported
base case values of 97% and 0.89, respectively. Because
a cost-saving result is a rare finding, additional and more
representative evidence is needed to consider it credible.

Conclusions

The initial evidence on telemedicine for routine neuro-
surgical follow-up care offers suggestive support that tele-
medicine can be feasible, safe, and clinically and cost-eff-
ective with patient acceptance, satisfaction, and a reduced
travel burden. Telemedicine may offer a win-win strategy
for the specialty center clinic access problem caused by
centralization of specialty services in a small number of
tertiary care hospitals in large urban centers covering vast
geographic areas, known as regionalization. While offer-
ing many advantages in both developed and developing
countries, regionalization imposes a costly travel burden
on many patients. An ironic, unintended consequence of
regionalization is that the more successful neurosurgery
centers are at providing surgical services, the greater the
demand and corresponding access gap for low-value non-
acute care services. Telemedicine may mitigate this gap
in both developed- and developing-country settings, with
the greatest relative benefit to rural, developing-country,
low-income populations who bear the greatest travel bur-
den. At the other extreme, telemedicine may be well ac-
cepted and cost-effective for urban, developed-country, high-income, tech-savvy populations who value enhanced convenience and the reduced travel burden.8

This new telemedicine cost-effectiveness study for post–neurosurgical follow-up care is one of a small handful of studies for specialty surgery,1,5,12 and considerably more studies are needed to overcome a dearth of evidence. Moving telemedicine into the mainstream requires shifting its evidence base from promising toward generalizable to address decision-maker and policymaker information needs. Although telemedicine interventions may be considered affordable based on neurosurgery clinics’ current staffing and technologies, and they may offer potential for significant patient and health system cost savings, there may be risks, concerns, and other costs constituting barriers to implementation.6 Future research demonstrating value sufficient to encourage adoption should provide rigorous, real-world practice comparative evaluation that is representative of neurosurgery telemedicine and in-person care costs in developing- and developed-country environments. A paradigm shift toward telemedicine and away from in-person specialist visits for routine neurosurgery follow-up care will depend on stakeholders’ confidence in the net benefit of this substitution, which could potentially include reducing the opportunity cost of neurosurgeons’ time spent on low-value outpatient clinic visits by replacing it with higher-value services, including surgeries.

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References

Disclosures
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