

Evolution of Thoracic Surgery at BP Koirala Memorial Cancer Hospital, Nepal: An 18 – Year Journey of Innovation and Growth.

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Abstract:

Background: Thoracic malignancies constitute 15% of Nepal's cancer burden, with lung cancer being the leading malignancy. This study aims at evolution of thoracic oncosurgery services at BP Koirala Memorial Cancer Hospital (BPKMCH) - Nepal's premier tertiary cancer hospital during a period of 18 years (2007-2025) to highlight procedural innovations, survival trends and resource-adapted strategies.

Methods: a retrospective analysis of 8683 surgical procedures stratified into: Foundation (2007-2010; open surgery), Expansion (2011-2015; Minimally Invasive transition), and Modernization (2016-2025, June; precision surgery). Data sources included hospital records, surgical database, and institutional publications.

Results: major surgeries increased 9-fold (106 in 2007 to 951 in 2024). Video-assisted thoracic surgery (VATS) biopsies achieved 98% diagnostic yield. Minimally invasive esophagectomy (MIS esophagectomy) rose from 0% to 80% ($p < 0.001$) with 5-OS improvement from 17% to 27% ($p = 0.003$). Pioneering milestones included Nepal's first minimally invasive esophagectomy (2009), VATS Thymectomy (2011), Subxiphoid Uniportal Non-intubated Thymectomy (2025) and VATS non-intubated S9 sub lobar pulmonary resection (2025).

Conclusion: BPKMCH has become Nepal's thoracic surgery referral hub through phased innovation. Future priorities include expansion of non-intubated thoracic surgeries and robotic surgeries.

Keywords: Thoracic surgery, Minimally invasive esophagectomy, Nepal

Introduction

GLOBOCAN 2022 revealed lung cancer to be the most common cancer worldwide (2480675 cases in 2022), and it carries the highest cancer related mortality (1817469 cases in 2022).¹

Thoracic malignancies account for 15% of Nepal's oncological burden, with lung cancer being the leading malignancy in males (15.6% and third in females (7.4%). Esophageal cancer lies at the 18th position.¹ A substantial load of thoracic malignancies are dealt at BP Koirala Memorial Cancer Hospital (BPKMCH), Nepal. A study on 10457 total cancer cases reported by National Hospital Based Cancer Registry in Nepal showed 43.9% of cancer cases were diagnosed at BPKMCH.² Established in 1998 as Nepal's premier tertiary cancer center, BPKMCH serves 30 million people, performing > 3500 annual operations. The Thoracic oncosurgery unit,

founded on December 4, 2006, pioneered complex oncological resections despite resource constraints. A separate thoracic ward was opened in 2009. This study synthesizes 18 years of evolution (2007-2025) drawing on publications by doctors of BPKMCH and institutional records and focuses mainly on procedural transformation, survival trends, unique challenges, key milestones and future perspectives.

Methodology

1. Study design: Retrospective study
2. Data collection: all the patients who were admitted and operated in Thoracic oncosurgery unit from 2007-2025 (till June 2025) were included for the study. Only patients who were operated for lung, esophageal, mediastinal and pleural neoplasms were reviewed separately whereas other procedures e.g. gastric,

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hepatopancreaticobiliary, colorectal, chest wall, soft tissue, breast, vascular and reconstructive procedures were not analyzed in detail.

3. Analytical framework: the study period was divided into three phases of evolution.
 - a. Foundation (2007-2010): Open surgery era
 - b. Expansion (2011-2015): Minimally invasive transition
 - c. Modernization (2016-2025): Advanced diagnostics and precision surgery
4. Sources: database from hospital record section, institutional surgical database, institutional annual reports and various publications by doctors of Thoracic Oncosurgery unit were reviewed.
5. Ethical approval: due to retrospective nature of study, individual consent was waived. Ethical approval was obtained from Institutional Review Board.
6. Statistical analysis: SPSS version 26 was used for Statistical analysis. Surgical volumes, techniques (open vs minimally invasive), complications, survival and key milestones were analyzed.

Results

Six beds were allocated to Thoracic Oncosurgery Unit. A dedicated Thoracic ward was established in year 2009 with six functioning beds which was increased up to 20 beds by year 2015. Flow of patient - Volume trend has been shown in Table 1 and Figure 1. Out-patient (OPD) flow, In-patient admissions and surgical procedures increased by 3, 5 and 9 folds, respectively.

Phase 1. Foundation (2007-2010):

There were two operating days/ week supported by basic pathology and radiology services. There was no dedicated ICU for thoracic cases.

Majority of the patients visiting the unit had suspicion of lung cancer. Bronchoscopy was the main diagnostic tool for pathological verification of lung cancer. During 2000-2009 period, 1074 patients underwent bronchoscopy. Central tumors were identified in 863 (80.4%); 545 (50.7%) had non-small cell lung carcinoma (NSCLC), 148 (13.8%) had small cell lung carcinoma (SCLC), and 246 (22.9%) had normal bronchoscopy.

Table 1. Patient volume Trends (2007-June 2025).

Year	OPD	In-patients	Major Surgery
2007	3812	182	106
2008	3532	177	103
2009	3899	221	197
2010	4954	317	233
2011	3892	271	215
2012	4225	323	276
2013	5190	333	280
2014	5190	344	430
2015	5317	372	371
2016	6061	413	351
2017	7192	361	383
2018	8645	517	521
2019	8648	668	689
2020	5200	452	466
2021	8719	644	692
2022	10536	834	905
2023	10536	848	983
2024	12226	895	951
2025 (Jan-June)	8239	569	531

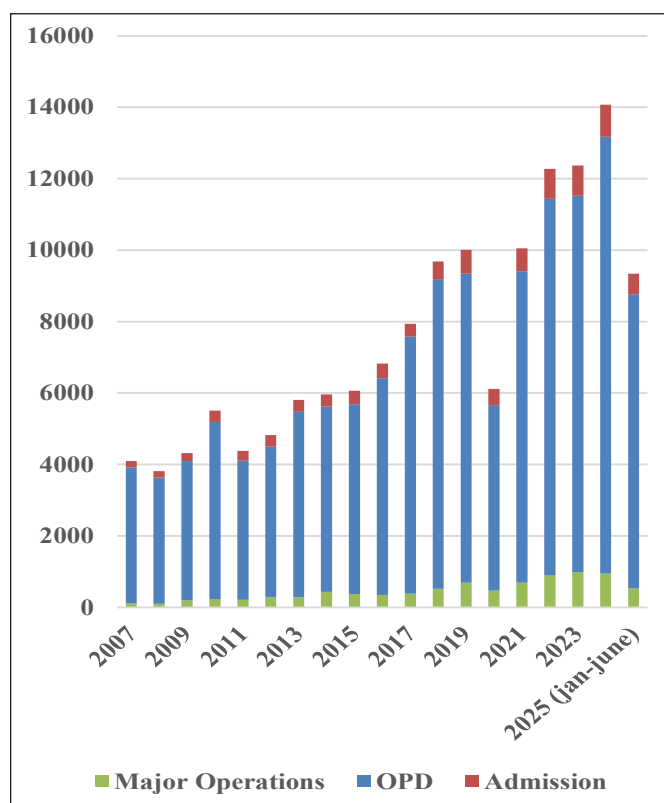


Fig 1. Patient volume trends.

Another major case load was for esophageal and gastroesophageal junction (GEJ) malignancies. Video-assisted thoracoscopic (VATS) and

laparoscopic approaches were started towards the middle of 2009. Hybrid VATS esophagectomy with gastric pull up was done in 2009 for cancer of hypopharynx (pharyngo-laryngo-esophagectomy) in a patient from Head and Neck unit of BPKMCH. In year 2010, first totally minimally invasive McKewon's esophagectomy was performed. VATS phase was done in lateral position.

Phase 2. Expansion (2011-2015):

There was a technological shift from open surgery to minimally invasive surgery (MIS). First VATS multi-port lobectomy as well as VATS multiport thymectomy was started in year 2011. VATS esophagectomy was changed from lateral approach to prone and later to semi prone position and first such surgery was performed on April 12, 2012.

In 2013, patients with esophageal and GEJ cancer who underwent surgery alone or multimodality treatment incorporating surgery (n=327) were analyzed. Final pathological stages (UICC 7th edition) were stages I (2.3%), II (13.8%), III (69.7%) and IV (7%). MIS and open surgery were performed in 25% and 75%, respectively. In-hospital mortality was 5.8%. A 5-OS of 22% was achieved.

Phase 3. Modernization (2016-2025):

During this period, there was an extensive expansion of work and research with innovative new techniques. There was greater advancement in both the diagnostic and surgical approaches. The long-term results of treatment of pulmonary, esophageal and mediastinal neoplasms were analyzed during this study period.

1. Pulmonary and pleural neoplasms:

In cases of undiagnosed pleural effusion, VATS biopsy has become a standard procedure at BPKMCH. A retrospective analysis in 149 such patients between 2015-2024 showed a diagnostic yield of 98% with malignancy being the most common cause (75.3%). postoperative minor complications were observed in 5 (3%) patients. There was no in-hospital mortality.

Pattern of surgical treatment among 250 lung cancer patients during 2001-2019 was studied. Surgery alone and multimodality treatment were done in 90 (36%) and 160 (64%), respectively. Lobectomy, pneumonectomy, bilobectomy, sleeve resection, sub lobar resection were done

in 214 (85.6%), 16 (6.4%), 10 (4%), 5 (2%) and 5 (2%), respectively.

2. Esophageal and GEJ cancer

215 patients were taken for MIS during 2001-2018. There was 11.2% conversion rate.

Mean operative time, intra operative blood loss, anastomotic leak, pulmonary infection, recurrent laryngeal nerve injury and in-hospital mortality were 246 min, 286 ml, 13.1%, 9%, 6.8% and 3%, respectively. Final histopathology revealed most common Stages III and IV in 51.2% and 36.1%, respectively. The median survival was 34 months, and 5-OS was 27%.

Trends in surgical management of esophageal cancer was studied in 547 patients during 2001-2018. A trend of neoadjuvant treatment from 9-13% to 52% ($p<0.001$) and minimally invasive surgery from 0% to 80% ($p<0.001$) and 5-OS increased from 17% to 27% ($p=.003$).

3. Mediastinum:

During 2000-2019, forty-nine patients with thymoma/ thymic carcinoma were analyzed. 40% underwent only surgical intervention while rest underwent multimodal treatment. VATS and open approach were considered in 8 (19%) and 34 (81%) respectively, 5-OS was 60%.

Fig 2-5 shows in-depth results of numbers of MIS and open surgery for the major thoracic neoplasms.

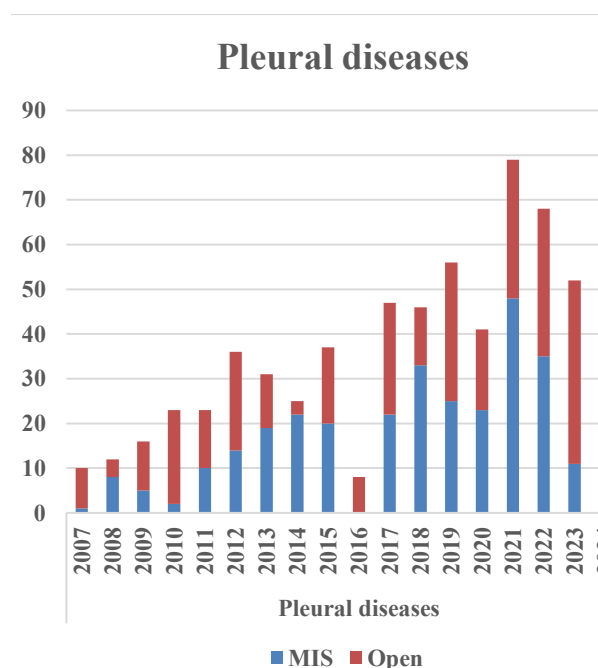


Fig. 2. Pleural neoplasms.

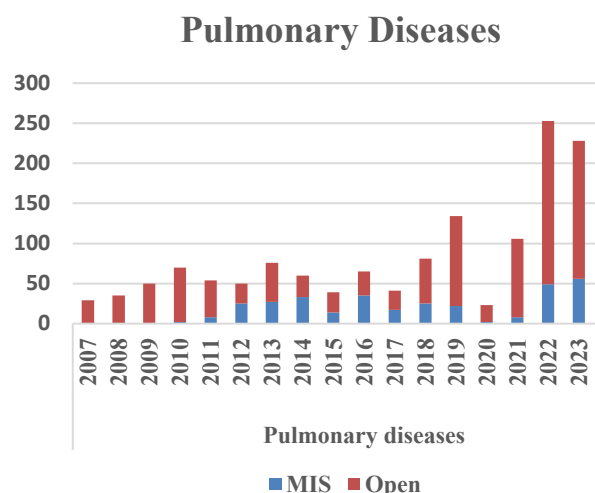


Fig. 3. Pulmonary neoplasms.

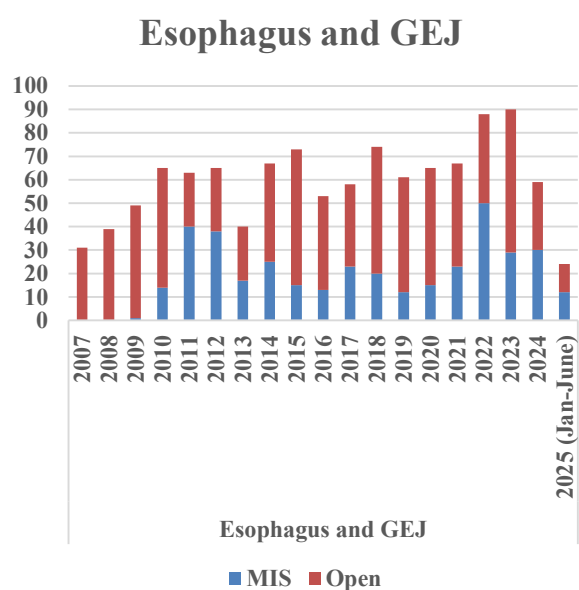


Fig. 4. Esophageal and GEJ neoplasms.

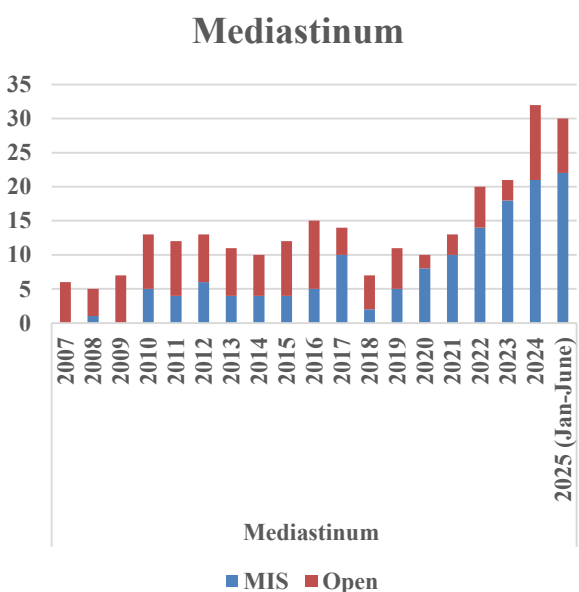


Fig. 5. Mediastinal neoplasms.

At BPKMCH, OPD patients, in-patients' admissions and volume of major surgeries took a persistent inclination since year 2007. In year 2024, total number of major operations were 951 and in the first six months of 2025 (Jan-June 2025), we have already performed 531 cases which included 49 cases of major pulmonary resections (lobectomy/ bilobectomy/ sleeve resections). VATS lobectomy accounted for 18 cases during Jan-June 2025. The operative cases are expected to rise.

During this period, below mentioned highly demanding procedures were performed:

On 14.04. 2024: subxiphoid multiportal radical thymectomy for myasthenia gravis.

On 22.05.2025: non-intubated subxiphoid uniportal radical thymectomy.

On 15.06.25: non-intubated VATS right S9 sub lobar resection.

Discussion

Thoracic malignancies are lethal neoplasms requiring multimodal approach and complex surgical procedures. Especially, lung cancer is the most commonly diagnosed cancer and leading cause of cancer death.^{1,3} Lung cancer is the leading cancer in Nepal as well.^{1,2} Similarly, esophageal surgery has been always considered extremely demanding procedure. Low et al compared complications of esophagectomy and pancreaticoduodenectomy utilizing Accordion severity grading system and found perioperative mortality and overall morbidity to be 0.4% and 46% post esophagectomy and 1% and 44% after Whipple's procedure. It shows esophagectomy is as challenging as Whipple's procedure.⁴

Establishing Thoracic Oncosurgery set-up and competing with the recent developments in thoracic oncology is a challenging task in low-income countries like Nepal due to poor infra-structure and lack of human resources/ thoracic surgeons. Due to similar issues, in one of the urban cities in Pakistan, Pervez et al implemented a wise model of providing the thoracic surgery services to people from 2012 onwards.⁵

BPKMCH has established itself as a center of excellence for esophageal cancer surgery. To the best of our knowledge, MIS esophagectomy in lateral position in 2009 and prone position in 2012 was performed for the first time in Nepal. Despite the majority of patients at stage III, 5-OS increased

from 17% to 27%.^{6,7,8} Analysis of 547 patients at BPKMCH showed a dramatic shift from 0% to 80% for MIS esophagectomy.⁸ This very well complies to the global acceptance of MIS esophagectomy as a standard of care.⁹

Despite the high incidence of lung cancer in Nepal, resectability was too low at BPKMCH due to advanced nature of disease.^{10,11} Data from BPKMCH showed the resectability rate of only 6.7% in 1000 patients.¹² Our team started VATS lobectomy lately due to technical difficulties and advanced nature of disease. But in early 2025, we have already accomplished 18 VATS lobectomies, and it has now become our routine practice for appropriate patients.

To the best of our knowledge, VATS multiport thymectomy was reported for the first time in Nepal by our team in year 2011.¹³ Later, the benefit of uniportal and moreover subxiphoid approach was realized by our team. There are several recent studies which have shown feasibility and safety, oncological outcome with reduced postoperative pain and better cosmesis.^{14,15} We could successfully perform multiport subxiphoid thymectomy in 2024 and uniportal subxiphoid thymectomy (non-intubated) in 2025. These cases were also the first cases from Nepal.

Thoracic surgery is moving rapidly in innovative direction. Few centers throughout the world, especially China and Spain have popularized the non-intubated VATS for major thoracic cases.¹⁶ such technique appears to be extremely useful for low-income countries like Nepal. It avoids endotracheal intubation, hence minimizes the intubation related complications as well as reduces the cost of surgery. Our team performed non-intubated VATS right S9 sub lobar resection of lung besides the thymectomy as mentioned earlier.

In 18 years of journey, thoracic oncosurgery unit has evolved from very basic procedures to innovative minimally invasive procedures and has established itself as a center of excellence in Nepal.

Conclusion

Despite various constraints, Thoracic Oncosurgery unit of BPKMCH has become one of the most dedicated high-volume center in Nepal competing with the international standards. The key milestones which were done for the first time in Nepal are worth emphasizing:

1. VATS esophagectomy in lateral position (2009)
2. VATS thymectomy (2011)
3. Totally MIS esophagectomy in prone position (2012)
4. Subxiphoid multiport radical thymectomy (2024)
5. Subxiphoid uniportal non-intubated radical thymectomy (2025)
6. VATS non-intubated right S9 sub lobar pulmonary resection (2025)

The future direction would be to perform more of NIVATS and to start in near future robotic thoracic surgery

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