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## Adrenal Incidentaloma Prevalence and Clinical Management- A Retrospective Study

Waleed Abdalrazig Dosogi Elzain<sup>1\*</sup>, Abdullah Mohammed Alshalaan<sup>1</sup>, Mohammed Mana Mohammed Al Qahtani<sup>1</sup>Hind Ali Abdullah Al Qahtani<sup>1</sup>, Dawlah Hadi Assiri<sup>1</sup>, Halimah Hussain Alshehri<sup>1</sup>, Eman Mohammed Alsultan<sup>1</sup>Fahad Obaid Mohammed Alnamshah<sup>1</sup>, Mohammed Abdullah Salem Alshehri<sup>1</sup>

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*Adrenal Incidentaloma, Adrenal Gland, Cushing's Syndrome, Diagnosis, Imaging, Surgery, Tumor*

### ABSTRACT

This study aims to investigate the characteristics and prevalence of adrenal incidentalomas and subsequent clinical practice among patients in Armed Forces Hospital Southern Region -Saudi Arabia, 2021. An observational retrospective study was conducted in Armed Forces Hospital Southern Region -Saudi Arabia on the medical records of 383 consecutive patients. Patients with incidental adrenal tumors who underwent abdominal CT scans with intravenous contrast during the period from January 2013 and December 2021. A total of 300 patients were included in this study. However, the data were analyzed using statistical tests. The results revealed that most patients with adrenal incidentalomas were above 60 (53.3%). The gender distribution was nearly equal, with 50.3% females and 49.7% males. Most observed tumors were unilateral (96.0%), while a small percentage was bilateral (4.0%). In terms of size, the majority were less than 1 cm (59.0%), followed by sizes greater than 4 cm (31.0%) and 1-4 cm (10.0%). Further analysis indicated that 49.3% were found to have functioning tumors, while 50.7% had non-functioning tumors. The specific types of functioning tumors included non-functioning adrenal adenoma (50.7%), pheochromocytoma (16.9%), Cushing's syndrome (5.8%), and other functional tumor types (28.0%). Most of these patients were not referred to endocrine clinics. Adrenal incidentalomas are prevalent in the above-60 age group, with most tumors being non-functional. Further research into adrenal incidentalomas associated with diabetes and hypertension is required.

### INTRODUCTION

An Adrenal Incidentalomas (AIs) is an unexpected tumor in one or both adrenal glands. These tumors can be benign (non-cancerous) or malignant (cancerous) (Nieman *et al.*, 2013; Terzolo *et al.*, 2011). These include adrenal cysts, hematomas, adrenal cortical carcinomas, adenomas, pheochromocytomas, myelolipomas, ganglioneuromas, metastases from various cancers, and other rare forms (Grumbach *et al.*, 2003). An AIs describes detecting an adrenal asymptomatic mass or tumor during imaging examinations such as Computed Tomography (CT) scans or Magnetic Resonance Imaging (MRIs) used for unrelated purposes (Francis & Mayo-Smith, 2023; Jason & Oltmann, 2019). Usually, these tumors are identified in people without symptoms or indicators associated with the adrenal gland. Abdominal CT scan has been widely used since the late 1970s and has proven highly effective in detecting adrenal pathology in individuals suspected of having adrenal disease. It is a valuable diagnostic tool for identifying abnormalities in the adrenal glands (Chatzellis & Kaltsas, 2019; Kim *et al.*, 2013). Furthermore, the first laparoscopic adrenalectomy was reported by Michel Gagner in 1992, marking a significant milestone in the field. This minimally invasive surgical technique quickly became the preferred approach for treating benign adrenal diseases (Serra, 2023).

The adrenal glands or suprarenal glands are small endocrine glands in each kidney. Despite their small size, these glands play a crucial role in hormonal regulation

(Kebebew, 2021). Each adrenal gland is divided into two main parts: the adrenal cortex (outer cortex) and the adrenal medulla (inner medulla), which have different functions and produce distinct hormones (Van Slycke *et al.*, 2022). These glands synthesize several necessary hormones, such as cortisol, aldosterone, and adrenaline. The hormones are essential for maintaining homeostasis, responding to stress, regulating metabolism, and influencing various bodily functions. Any dysfunction or abnormalities in the adrenal glands can lead to hormonal imbalances and various health conditions (Lyraki & Schedl, 2021). Most adrenal incidentalomas are non-functioning, meaning they do not generate abnormally high levels of hormones and manifest as symptoms (Francis & Mayo-Smith, 2023). In many cases, adrenal incidentalomas do not cause symptoms and are non-functioning. However, some adrenal incidentalomas may exhibit certain symptoms and characteristics (Imbroll *et al.*, 2020; Kim *et al.*, 2013).

### LITERATURE REVIEW

#### Adrenal Incidentalomas Symptoms

Adrenal incidentalomas often do not cause specific symptoms directly related to the adrenal gland (Jabarkhel, 2019). However, if the mass is large or functioning, it can cause symptoms related to hormone overproduction or local compression of nearby structures. These symptoms may include: Hypertension (high blood pressure), excessive sweating, unexplained weight gain or weight

<sup>1</sup> Armed Forces Hospital, Southern Region KSA, Tamniah, Saudi Arabia

\* Corresponding author's e-mail: [Waleeddosogi@yahoo.com](mailto:Waleeddosogi@yahoo.com)

loss, palpitations or rapid heart rate, anxiety or panic attacks, abdominal or back pain (if the mass is large and causing compression), changes in menstrual cycles (in women), muscle weakness, and sleep disturbances (Nieman *et al.*, 2013). Moreover, the characteristics of adrenal incidentalomas can be assessed through imaging studies, such as CT scans or MRI (Yilmaz *et al.*, 2021).

### Prevalence of AIs

The prevalence of adrenal incidentalomas has increased with the widespread use of imaging techniques (Ichijo *et al.*, 2020). These masses are often benign, but a small percentage can be cancerous. Therefore, when an adrenal incidentaloma is detected, further evaluation is necessary to determine its nature and potential impact on health (Sconfienza *et al.*, 2023). Due to limited population-based research, determining AI's exact prevalence and incidence is challenging. The available data primarily comes from retrospective postmortem and radiological investigations, which lack comprehensive clinical information, may be biased in referrals, and involve varying patient selection criteria (Chatzellis & Kaltsas, 2019). The prevalence of adrenal incidentalomas in the general population ranges from approximately 1% to 6%, with the incidence increasing with age (Kebebew, 2021). While these masses are rare in childhood, they affect around 3% of individuals over 50 and over 7% of those over 70 (Jackson, 2023; Jing *et al.*, 2022) and even less frequently in individuals who are under 40 years old (Sherlock *et al.*, 2020).

### Adrenal Incidentalomas Insights

In 2018, a significant number of CT and MRI scans were performed, with 6 million CT scans and 3.8 million MRI scans (in any anatomical region) reported by the National Health Service (NHS) Diagnostic Imaging Datasets (Cuthbertson *et al.*, 2023; Kebebew, 2021). Most adrenal incidentalomas are benign, but about 2% represent primary adrenal malignancies. Morphological and functional status are the 2 key issues with an adrenal incidentaloma. AIs are often benign adenomas with a malignancy incidence of between 1.9% and 4.7% (Fassnacht *et al.*, 2016). The majority of adrenal incidentalomas (80%) are nonfunctioning adenomas. Autonomous cortisol secretion is the primary cause of adrenal hypersecretion, which accounts for 1%–29% of cases. Pheochromocytomas account for 1.5%–14% of cases, and aldosterone-secreting tumors account for 1.6%–3.3% of cases (Jackson, 2023).

### Key Considerations in Managing AIs

Adrenal incidentaloma (AI) is a hormonally functional or malignant tumor, (Griffing, 2022) with 14% being functional tumors secreting excessive hormone levels (Bancos & Prete, 2021). The diagnosis and treatment of AI are significantly influenced by their size (Aron *et al.*, 2012) with adrenal masses less than 1 cm considered not real AI unless there are clinical symptoms of increased adrenal hormone production. (Terzolo *et al.*, 2011). The

National Institute of Health (NIH) consensus in 2002 categorized adrenal tumors into low risk, uncertain, and high risk (Şenoğlu *et al.*, 2022). Moreover, larger than 6 cm tumors are generally considered surgically indicated due to the increased risk of malignancy (Zeiger *et al.*, 2011). The decision regarding surgical intervention is individualized for those measuring 4–6 cm, considering factors such as the patient's overall health, symptoms, radiological characteristics, and the likelihood of malignancy (Jackson, 2023; Kahramangil *et al.*, 2022). Techniques like laparoscopic or retroperitoneoscopic adrenalectomy are commonly employed, offering advantages like smaller incisions, reduced postoperative pain, shorter hospital stays, and faster recovery compared to traditional open surgery (Sada & McKenzie, 2023; Sancho *et al.*, 2012). Therefore, this study aims to identify the prevalence of adrenal incidentaloma and subsequent clinical practice among 383 consecutive patients in Armed Forces Hospital.

## MATERIALS AND METHODS

### Study Design

An observational and retrospective study approach was employed.

### Ethical Approval

Approval for the study was granted by the research ethics committee of Armed Forces Hospital Southern Region, Saudi Arabia (AFHSRMREC/2022/INTERNAL MEDICINE/636). A written informed consent form from each participant was obtained. Moreover, the study was carried out in conformity with the 1964 Declaration of Helsinki and any subsequent revisions, or with comparable ethical standards.

### Study Setting and Period

The study was conducted in Armed Forces Hospital Southern Region - Saudi Arabia, during the period from January 2013 and December 2021.

### Study Sample and Population Size

The study examined the medical records of 383 consecutive adult patients who had undergone abdominal CT scans with intravenous contrast at the Armed Forces Hospital Southern Region in Saudi Arabia. The researchers specifically focused on patients who were found to have adrenal incidentalomas during the study period, resulting in a total of 300 patients included in the study.

### Inclusion and Exclusion Criteria

The study's inclusion criteria encompassed male and female adult patients aged 18 years or older who had undergone abdominal CT scans with intravenous contrast and were diagnosed with adrenal incidentalomas. The exclusion criteria depend on benign lesions, additional diagnostic workup, diagnostic clarity, urgent need for intervention, patient age, incomplete data, ethical or

legal considerations, radiological characteristics and other medical conditions. A total of 83 patients were excluded from the study who did not meet inclusion criteria.

### Data Collection

The primary researchers used specific sampling methods to gather data from human participants, including recruitment, inclusion/exclusion criteria, and selection, while considering potential risks and benefits.

### Data Analysis

The study used SPSS 25.0 version for data analysis, utilizing descriptive statistics and bivariate analysis to determine associations between outcome variables and influencing factors. Categorical variables were analyzed using the Chi-square test, while quantitative variables were analyzed using the t-test. A p-value of 0.05 or less was considered statistically significant.

## RESULTS

The results section displays data analysis and statistical interpretations based on sampling methods and collected data. Frequencies and percentages were used for statistical analysis. The demographic characteristics of participants are shown in Table 1. The adenoma discovery and referral correlation are represented in Table 2 and Table 3, respectively.

Table 1 shows that out of the 300 patients with incidental adrenal tumors, 53.3% were above 60 years, 30% were

between 41 and 60 years, and 16.7% were between 20 and 40 years. Among the patients, 50.3% were females, and 49.7% were males, resulting in an almost equal male-to-female ratio (1:1). The majority of the patients, 96.3%, were of Saudi nationality. Non-Saudi patients represented a smaller proportion, comprising only 3.7% (11 patients) of the total population.

Figure 1 presents information on patients' frequency and percentage distribution based on three demographic factors: age, gender, and nationality. A total of 300 patients were included in the analysis.

Table 2 shows adrenal incidentalomas characteristics in a population of 300 patients. Most were unilateral, with 59.0% measuring less than 1 cm. The remaining 31.0% had tumors larger than 4 cm. Functioning tumors associated with hormonal secretion were 49.3%, while non-functioning tumors did not produce hormones.

Table 3 shows a significant association between referral to endocrine clinic, requesting doctor, and abdominal CT utilization, with a correlation between requesting doctors and endocrinologist referrals.

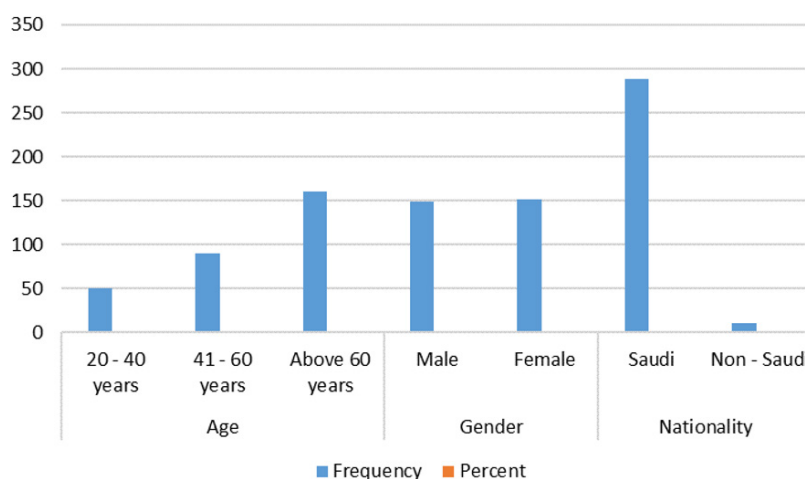
Figure 2 shows that 44.0% of abdominal CT scan requests were made by Endocrinologists, with the remaining 56.0% made by other doctors, involving 300 patients.

Figure 3 demonstrates the distribution of unilateral and bilateral cases among the patients with adrenal incidentalomas. According to the data, 96.0% of the cases were unilateral, while only 4.0% were bilateral.

Figure 4 displays the distribution of adrenal incidentalomas

**Table 1:** The demographic data of the patients with incidentaloma

Factors		Frequency	Percent
Age	20 - 40 years	50	16.7%
	41 - 60 years	90	30.0%
	Above 60 years	160	53.3%
Gender	Male	149	49.7%
	Female	151	50.3%
Nationality	Saudi	289	96.3%
	Non - Saudi	11	3.7%



**Figure 1:** The demographic data of the patients with incidentaloma

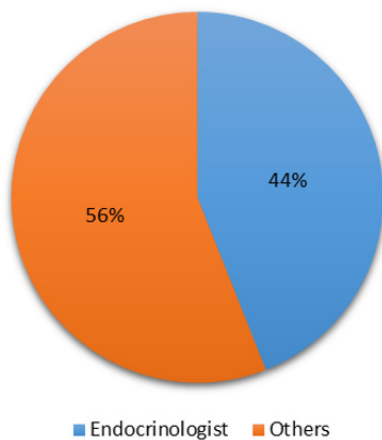
**Table 2:** The finding of incidental adenoma from abdominal CT and further workup

		Frequency	Percent
Site	Unilateral	288	96.0%
	Bilateral	12	4.0%
Size	< 1 cm	177	59.0%
	1 – 4 cm	30	10.0%
	>4 cm	93	31.0%
Activity	Functioning	148	49.3%
	Non-functioning	152	50.7%

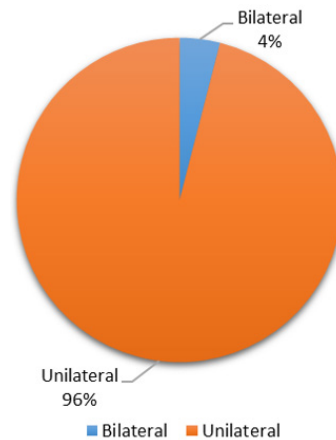
**Table 3:** The correlation between the referral to the endocrine clinic with the requesting doctor and abdominal CT using the chi-square test

		Refer to the Endocrine clinic		Total	P value
		Yes	No		
Requesting doctor	Endocrinologist	115	17	132	0.00*
		50.0%	24.3%	44%	
	Others	115	53	168	
		50.0%	75.7%	56%	
Abdominal CT	Unilateral	230	66	296	0.382
		100.0%	94.3%	98.7%	
	Bilateral	0	4	4	
		0.0%	5.7%	1.3%	

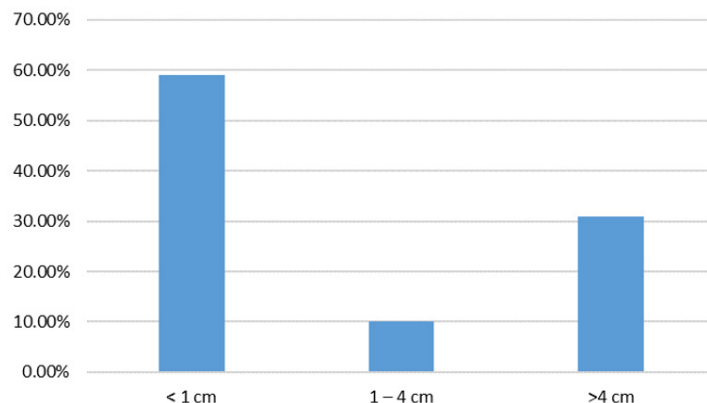
\*Significant correlation



**Figure 2:** The frequencies of the specialty of requesting a doctor of CT



**Figure 3:** The distribution of the findings of adrenal incidentaloma in abdominal CT



**Figure 4:** The frequencies of the lesion size in abdominal CT

based on their sizes. According to the data, 59.0% of the incidentalomas were smaller than 1 cm, 31.0% were larger than 4 cm, and 10.0% measured between 1-4 cm.

Figure 5 shows that 50.0% of patients with adrenal incidentalomas were referred for further evaluation or management, while 24.3% were not referred.

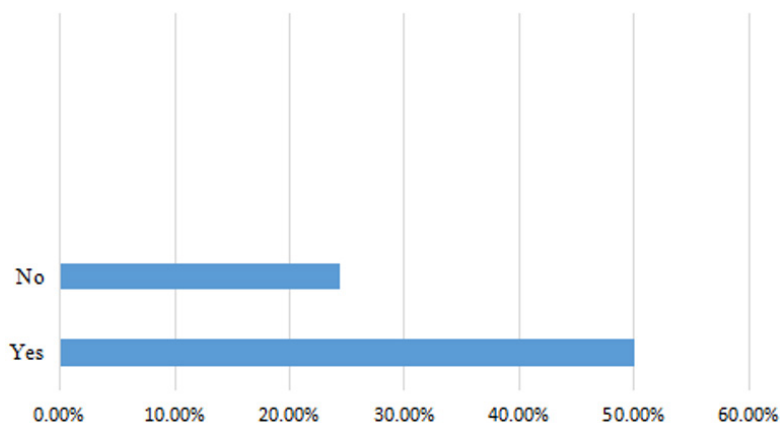
Figure 6 shows that 50.0% of patients with adrenal incidentalomas were referred to others for further evaluation or management, while 75.7% were not referred.

Figure 7 shows that 30.2% of patients with adrenal

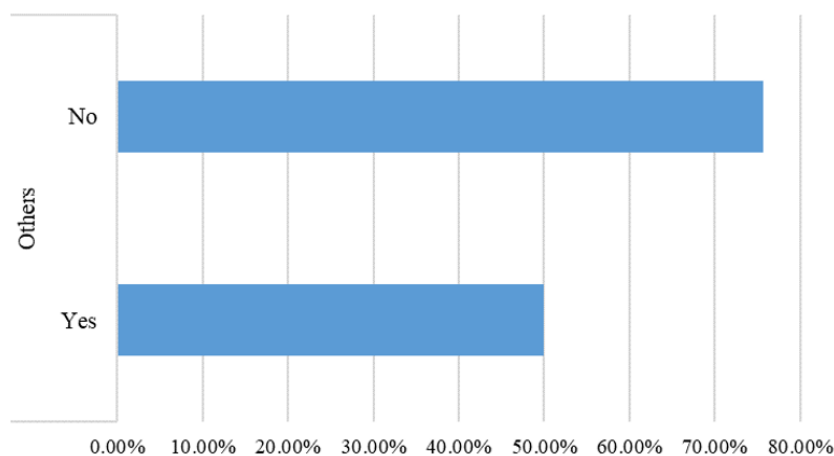
incidentalomas underwent additional investigations, while 69.8% did not undergo further work-up.

Figure 8 shows patients with adrenal incidentalomas, with 49.3% having functioning tumors and 50.7% having non-functioning ones, after additional investigations.

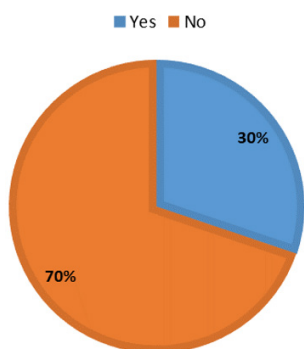
Figure 9 shows that out of 18 patients with available findings, 50.7% had non-functioning adrenal adenoma, 16.9% had pheochromocytoma, 5.8% had Cushing's syndrome, and 28.0% had other functional adrenal tumors.



**Figure 5:** The distribution of the patients according to the referral to an endocrinologist after the incidental finding in abdominal CT



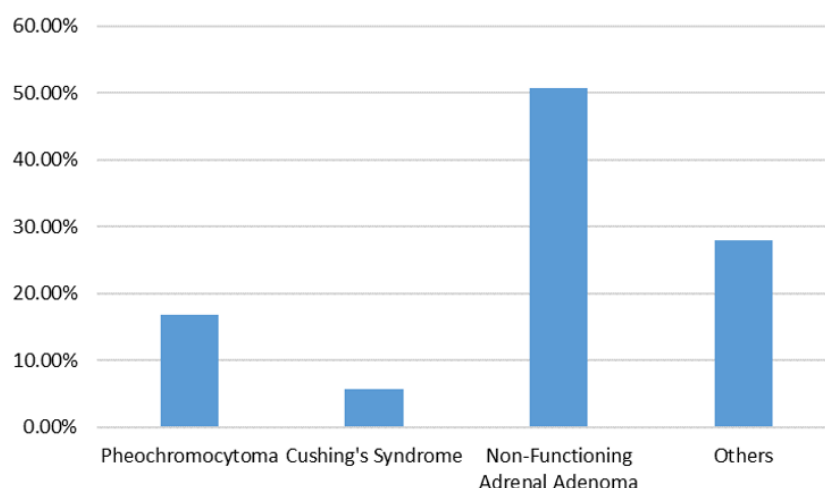
**Figure 6:** The distribution of the patients according to the requesting doctors to others after the incidental finding in abdominal CT



**Figure 7:** The distribution of the patients according to the further workup for the patients after the incidental finding in abdominal CT



**Figure 8:** The distribution of the patients according to the findings of further workup



**Figure 9:** The distribution of the patients according to the lab diagnosis of the patients

## DISCUSSION

An adrenal incidentaloma is an adrenal lesion incidentally detected during a radiological examination for reasons unrelated to suspected adrenal disease (Rowe *et al.*, 2023; Shaikh *et al.*, 2023; Zeiger *et al.*, 2011). Moreover, the evaluation of adrenal incidentaloma can be done by medical history, review of the patient's symptoms, physical examination, body weight, pulse rate, blood pressure, genetic tests, and blood or urine testing to measure hormone levels and rule out pheochromocytoma (Nieman *et al.*, 2013).

The present study examined 300 patients who underwent abdominal CT scans at the Armed Forces Hospital Southern Region in Saudi Arabia to determine the prevalence and features of incidental adrenal tumors. The results showed that age significantly influences the formation of these tumors, with an increased prevalence observed in older age groups. The ratio of male to female cancers was almost equal, indicating no gender difference in the incidence. The majority of patients were Saudi nationals, possibly due to the demographic characteristics of the population or the unique healthcare setting. Unilateral tumors were more prevalent than bilateral ones, and most were small, measuring less than 1 cm. A significant number of tumors were non-functional, while a smaller portion secreted hormones. The study also found a significant correlation between the doctor's request and the patient's referral to the endocrine clinic. These findings can help in clinical decision-making and patient care.

Moreover, Secreting syndromes can be diagnosed using various criteria, including Cushing's syndrome, primary aldosteronism, pheochromocytoma, and androgen or estrogen excess. Cushing's syndrome is diagnosed by elevated cortisol levels, confirmed by UFC measurements and salivary cortisol testing. Primary aldosteronism involves tests like the aldosterone-to-renin ratio (ARR) test, saline infusion test, captopril challenge test, and confirmatory salt-loading test. Pheochromocytoma is diagnosed by measurements of plasma or urinary

metanephrines or catecholamines, with imaging studies like CT or MRI scans.

Adrenal gland disorders can be caused by various factors, including excessive hormone production, leading to functional tumors (Yilmaz *et al.*, 2021) like Cushing's syndrome, hyperaldosteronism, pheochromocytoma, congenital adrenal hyperplasia, and adrenal gland cancer (Terzolo *et al.*, 2012). Conversely, non-functional tumors, such as adenomas, cysts, and less common conditions like fatty or blood cell tumors, can result from these conditions. It's crucial to differentiate between hormonally active and non-functional tumors for better diagnosis and treatment (Nieman *et al.*, 2013).

Diabetes and hypertension are associated with adrenal incidentalomas, non-functional tumors that do not produce hormones (Reimondo *et al.*, 2020). Some of them produce cortisol, which causes increased cortisol levels that might result in hypertension (Szyclińska *et al.*, 2023). Adrenal incidentalomas that produce aldosterone can cause primary aldosteronism, leading to hypertension (Hiraishi *et al.*, 2011; Vilela & Almeida, 2017). Severe hypertension can be caused by pheochromocytomas, which produce too much noradrenaline and adrenaline (Zuber *et al.*, 2011). Adrenal incidentalomas and diabetes possess a less direct link than they do with hypertension. Adrenal tumors can occasionally impact how the body processes glucose (Higgs *et al.*, 2022; Muscogiuri *et al.*, 2011). For example, cortisol-producing tumors can cause insulin resistance, which in certain people can progress to type 2 diabetes (Higgs *et al.*, 2022; Sydney *et al.*, 2019). However, not all incidentalomas of the adrenal gland are linked to either diabetes or hypertension. Patients with adrenal incidentalomas need a complete evaluation, which should include hormonal testing, to identify if the tumor is overproducing hormones and contributing to these symptoms (Arnaldi & Boscaro, 2012; Terzolo *et al.*, 2012). Moreover, the distribution of pathological origins in adrenal incidentalomas varies depending on important clinical factors, such as cancer history and tumor size (KHALIL & ASA, 2023). When considering patients

with a history of cancer, including lung, breast, kidney, and melanoma carcinomas, it has been observed that up to 75% of incidentalomas are metastases (Samsel *et al.*, 2023). However, in cases with no identified primary cancer site, the prospect of a metastatic lesion causing the adrenal incidentaloma is very low (Dunn *et al.*, 2022). Instead, primary adrenocortical carcinoma becomes a more probable cause of a malignant adrenal tumor (Demidowich *et al.*, 2019). Therefore, patients with an adrenal incidentaloma must undergo a comprehensive clinical evaluation (Calissendorff *et al.*, 2023). This evaluation should include a thorough assessment of medical history and a physical examination to exclude the presence of a functional tumor or an underlying malignancy (Spartalis *et al.*, 2019).

The symptoms experienced by individuals with adrenal tumors can vary depending on whether the tumor is functional or nonfunctional, as well as the specific hormones being overproduced. Excessive cortisol production can lead to weight loss, skin stretch marks, acne, muscle weakness, depression, anxiety, fatigue, and sleep disturbances (Nieman *et al.*, 2013). Women may experience hair growth, irregular menstrual periods, and elevated cortisol levels, leading to high blood pressure, blood sugar, and decreased bone density. Excessive norepinephrine or epinephrine can cause symptoms like heartbeat irregularity, sweating, headaches, trembling, and pale complexion (Nieman *et al.*, 2013; Terzolo *et al.*, 2012). In patients with adrenal incidentalomas, the diagnostic approach should address two key questions: determining whether the lesion is malignant and assessing its hormonal activity (Crafa *et al.*, 2022). Radiological assessment, utilizing computed tomography (CT) with both non-contrast and contrast phases, is the most effective method for distinguishing between benign and malignant adrenal masses by analyzing attenuation values expressed in Hounsfield units (Korivi & Elsayes, 2013). Surgical excision is recommended for adrenal tumors with suspicious radiological findings, most functional tumors, and all tumors larger than 4 cm without typical features of benign masses (Zeiger *et al.*, 2011). In addition, it is important to conduct hormonal evaluations for subclinical Cushing's syndrome and pheochromocytoma in all patients, and those with hypertension should be evaluated for hyperaldosteronism. Initial hormonal assessments can include a combined 1-mg dexamethasone suppression test, plasma metanephrines, and aldosterone/plasma renin activity measurements for hypertensive patients (Schumm *et al.*, 2023; Terzolo *et al.*, 2012).

Consequently, the size of adrenal tumors plays a significant role in distinguishing between benign and malignant adrenal adenomas (Farrugia *et al.*, 2017). Typically, tumors smaller than 3 cm are more likely benign, while malignant lesions are usually larger than 6 cm. Different cutoff values, ranging from 4 to 6 cm, have been suggested for surgical removal of adrenal masses. However, a 5-cm homogenous adrenal mass with a non-contrast attenuation value of less than 10

Hounsfield units (HU) has a very low risk of malignancy (Wale *et al.*, 2017). Studies have shown that 5 to 25% of nonfunctioning adrenal masses can increase in size by at least 1 cm during follow-up, suggesting that size stability does not guarantee an adrenal tumor's benign nature (Bhat & Tiyyath, 2017). Furthermore, with the advancement of modern CT scanners, it has become easier to identify and differentiate both adrenal glands (Suvannareg *et al.*, 2018). In some cases, it is even possible to distinguish between the cortex and medulla of the glands using CT scans. Three key imaging criteria are crucial when distinguishing between benign and malignant adrenal lesions. These criteria include the lesion size, the CT attenuation value observed on an unenhanced CT scan, and the pattern of enhancement and de-enhancement, commonly called washout (Zeiger *et al.*, 2011). By assessing these criteria, radiologists can make a more accurate determination regarding the nature of the adrenal lesion (Albano *et al.*, 2019).

During the time specified, a total of 383 consecutive patients underwent abdominal CT scans with intravenous contrast. However, this observational study involved 300 cases of incidental adrenal tumors to identify the prevalence of Adrenal incidentaloma. According to Abdurrahman C. *et al.*, 2010, the most common radiological intervention used to detect adrenal masses is CT imaging (Comlekci *et al.*, 2010). Their study also found that the age group most frequently affected by adrenal masses was above 60, slightly higher than that reported by Bhargav P. *et al.*, 2008 (Bhargav *et al.*, 2008). Regarding gender distribution, the current study revealed that 50.3% of the patients were females and 49.7% were males, indicating a nearly equal male-to-female ratio. This finding aligns with the study conducted by Bhargav P. *et al.*, 2008 (Bhargav *et al.*, 2008). However, Abdurrahman C. *et al.*, 2010 (Comlekci *et al.*, 2010) reported a female predominance of approximately 70%, which differs from the current study. Interestingly, a study by Seong H. *et al.*, 2018 reported a higher male predominance. These variations in gender distribution among different studies suggest that gender preferences may not be specific or consistent and could vary based on region-specific factors (Ahn *et al.*, 2018). The study revealed that only 44% of the CT scans were requested by endocrinologists, indicating a lack of awareness or consideration of adrenal incidentalomas by other healthcare providers. Most adrenal incidentalomas were found to be unilateral (96%), with only (4%) of cases being bilateral. Most of these tumors were small, measuring less than 1 cm (59.0%). However, Bhargav P. *et al.*, 2008 reported larger tumor sizes; in 91% of cases, the adrenal tumors were larger than 3 cm, while in 70% of cases, the tumors were larger than 6 cm (Bhargav *et al.*, 2008).

Further work-up was conducted for only 30% of the cases in the current study. Among those who underwent further evaluation, 49.3% had functional adenomas, consistent with the findings of Bhargav P. *et al.*, 2008 who reported functional tumors in about 41.5% of cases.

Moreover, Seong H. *et al.*, 2018 reported that most of the tumors were non-functional. Although generally benign with small sizes and slow progression, functional tumors may be associated with developing conditions like diabetes mellitus and hypertension, particularly in individuals over 60 (Ahn *et al.*, 2018). Furthermore, laboratory diagnosis revealed that 50.7% of the cases were non-functioning adrenal adenomas, 16.9% were pheochromocytomas, 5.8% were associated with Cushing syndrome, and 28.0% were classified as other types. A significant correlation was observed between the requesting doctors and referral to endocrinologists. This finding suggests that patients referred by doctors other than endocrinologists are less likely to be directed to endocrine clinics, indicating potential neglect or management with other medical disciplines.

In summary, the study highlights the underutilization of endocrinologists in evaluating and managing adrenal incidentalomas, primarily due to the prevalence of unilateral and small-sized tumors. Functional tumors and referral patterns contribute to understanding the management of adrenal incidentalomas. Surgery may be necessary for 85% of non-functioning tumors, and hormone treatment may be necessary for hormonal imbalances. Consultation with a medical team, genetic counseling, and regular follow-up appointments are recommended. Further, the study emphasizes the need for a multidisciplinary approach in assessing and treating diseases, especially in individuals aged 60 or older, and highlights no gender disparity in their occurrence. It underscores the importance of diligent surveillance in the elderly population for improved patient care.

## CONCLUSION

In conclusion, The study highlights the higher prevalence of adrenal incidentalomas in older individuals, with functional tumors in most cases, emphasizing the need for careful evaluation and monitoring. Further research and guidelines are needed to understand the natural history, optimal evaluation strategies, and long-term outcomes of adrenal incidentalomas. Patient education is important to facilitate their participation in decision-making and adherence to follow-up protocols. By implementing these recommendations, healthcare providers can enhance the management and outcomes of patients with adrenal incidentalomas, improving their overall care and well-being.

## Strengths and Limitations

- It emphasizes the importance of a multidisciplinary approach involving endocrinologists, radiologists, and other specialists, to evaluate and manage these tumors.
- However, the data was collected from a single center, which may limit generalizability to other settings or populations.

## RECOMMENDATIONS

Based on the study's findings, recommendations, as follows, can be made:

- Conduct more studies on AI prevalence and the association between HTN and AI with DM, as well as further research on the relationship between HTN and AI.
- To maintain and enhance the recording system of the hospital.
- Healthcare professionals should be aware of the high prevalence of adrenal incidentalomas, particularly among individuals aged over 60 years.
- Long-term monitoring is essential to detect any changes in size or hormonal activity over time.
- Individualized treatment approaches should be tailored to each patient's age, comorbidities, tumor size, and functional status.

## Acknowledgments

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## Trial Registration Number

Approval for the study was granted by the Research Ethics Committee of Armed Forces Hospital Southern Region, Saudi Arabia and the registration number is (AFHSRMREC/2022/INTERNAL MEDICINE/636).

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