Immunopathol Persa. 2022;x(x):e29324 Original

Immunopathologia Persa

http www.immunopathol.com

DOI:10.34172/ipp.2022.29324

Designing a data set for registry of patients with adrenal insufficiency

Mehrnoosh Zakerkish[1], **Mahboubeh Taghipour**[2*], **Hajieh Shahbazian**[2], **Sedigheh Nouhjah**[2], **Seyed Mahmoud Latifi**[2]

[1]Department of Internal Medicine, Diabetes Research Centre, Health Research Institute, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[2]Diabetes Research Center, Health Research Institute, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

***Correspondence to**
Mahboubeh Taghipour, Email: Mahboobe.t.2007@gmail.com

Received 6 Nov. 2021
Accepted 3 May 2022

Keywords: Adrenal insufficiency, Delphi technique, Data set

Abstract

Introduction: Adrenal insufficiency is one of the most important life-threatening disorders with serious complications. Establishing a standard data element can provide earlier diagnosis, timely treatment, and follow-up to reduce disease crisis.

Objectives: This study aimed to draft a data set for the registry of patients with adrenal insufficiency.

Patients and Methods: The present cross-sectional study developed data elements for the registry of patients with adrenal insufficiency using a two-round Delphi technique of 2015. The informational elements selected by more than 75% of participants with a value of “very high” and “high” were accepted as the main elements.

Results: The final data set included four main groups, 15 subclass and 114 data elements for the registry of patients with adrenal insufficiency. Our results have demonstrated that the primary data groups include administrative data; signs, symptoms, medical and family history data elements; paraclinical diagnostic data, treatment, and follow-up data to improve patient management.

Conclusion: This study designed data set registry forms for patients with adrenal insufficiency using a standard method. Our finding indicated that, applying a uniform data set can provide better data management, patient care, and prevention of disease complications, especially in adrenal insufficiency disorder.

Citation: Zakerkish M, Taghipour M, Shahbazian H, Nouhjah S, Latifi SM. Designing a data set for registry of patients with adrenal insufficiency. Immunopathol Persa. 2022;x(x):e29324. DOI:10.34172/ipp.2022.29324.

Introduction

The adrenal glands produce and release vital hormones that play essential roles in different physiological functions, including metabolism regulation, control of body homeostasis, response to stress, and the immune system stimulant (1). The adrenal cortex specializes in the production of steroids, including glucocorticoids, mineralocorticoids and androgens (1). Catecholamine is also secreted from chromaffin cells of the adrenal medulla (2,3). Adrenal disorders include diseases that are caused by excessive or insufficient hormone secretion (4). Delay in the diagnosis and treatment of some of these disorders can even lead to the patient’s death that one of the most important ones is adrenal insufficiency (4,5).

Adrenal insufficiency is a life-threatening disorder associated with high mortality risk, reduced life expectancy and the quality of life (5,6). This pathologic condition is characterized by reduced production or action of glucocorticoids and a lack of mineralocorticoids or adrenal androgens (4,7). The disease classification based on the involved organs includes primary (adrenal cortex), secondary (anterior pituitary), and third (hypothalamus) (5). Unfortunately, most affected patients die within the initial five years of recognition without timely steroid replacement therapy (8). In addition, adrenal crisis, as the acute form of the disease, is a significant cause of death which needs medical emergency in these patients (9). Primary adrenal insufficiency is created by direct involvement of the adrenal gland (6). However, various illnesses can also lead to this disorder, including isolated autoimmune diseases with adrenal gland involvement alone or together with the autoimmune polyglandular syndrome (APS) (type I APS and type II APS), infectious diseases (the most common underlying microorganism

Key point

The present study carried out to design a data set registry for adrenal insufficiency patients as one of the most important life-threatening disorders using a two-round Delphi technique. The final data set included four main groups, 15 subclass and 114 data elements to improve patients care and disease management.

is tuberculosis worldwide), fungal infections such as Cryptococcus, and even genetic disorders such as medium-chain fatty acid oxidation disorder (6).

Nevertheless, in most cases, the disease is iatrogenic (exogenous Cushing's syndrome) and occurs as a result of glucocorticoids usage for other reasons (10). For instance, in rheumatic diseases, such as rheumatoid arthritis, Crohn's disease, lupus, in which the hypothalamic-pituitary-adrenal axis is suppressed and dependent on exogenous glucocorticoid consumption; in case of glucocorticoid abrupt cessation, or other stressful conditions, e.g., fever and stress, adrenal glands would be incapable of compensating for glucocorticoid secretion (4,5,10).

The secondary type of adrenal insufficiency is initiated by reducing adrenocorticotropic hormone (ACTH) secretion from the pituitary gland (11). However, primary adrenal insufficiency is associated with a higher risk of adrenal crisis and occurs in more than fifty percent of patients with Addison's disease (12). Therefore, access to patient information such as clinical and family history, signs and symptoms, laboratory results, previous treatment and follow-up data in a health care information system is critical, beneficial and helpful for physicians to propose a precise therapeutic strategy (13).

Since the first step for establishing a standard registry system is designing a data set with a reliable method, a uniform approach in data collection provides better disease management and patient care and the prevention of probable complications (14). Furthermore, applying a data set enables us to monitor the health system services and prepare precise statistical reports (15). Moreover, it can help to registry system in decision-making, time-saving and provide more accessible and cost-effective medical research (14,15).

Objectives

Due to the importance of adrenal insufficiency management, complications and lack of a national registry system, this study aimed to draft a data set for registry of patients with adrenal insufficiency.

Patients and Methods

The participants of the present study were Iranian internists and endocrinologists. This study was conducted using checklists containing significant informational elements in evaluating clinical and laboratory symptoms of disease diagnosis, treatment, and follow-up. The applied checklists were based on the Delphi technique, in which the experts discussed the necessity of containing elements.

Study design

The present study was a cross-sectional survey conducted using an approved questionnaire that its reliability and validity were evaluated and confirmed by experts' opinions. The approved questionnaires were then distributed to internists (50%) and endocrinologists (50%) through email or social media throughout Iran.

The applied terms should be clear and in accordance with known references and should not have any ambiguity. Since the participants of this study were internists and endocrinologist experts, there was no misunderstanding of the used terms.

The intended subjects evaluated the target item and assessed the importance percentage as very high, high, or low.

Data analysis

Data analysis were performed according to the second round of the Delphi method using descriptive statistics in SPSS software.

Decision making about questions was as follows:

a. The main element was included in the patient's record if 75% or more responders chose the very high or high grade for the question corresponding to that data.
b. The item was selected as the main element if 50-75% of responders chose the very high and high option for that data.
c. If less than 50% of the subjects chose the very high and high options, the element was discarded.

Results

The questionnaires were sent to 60 subjects, and 41 out of all were completed and returned (Table 1). The final checklists for the minimum informational data of adrenal insufficiency were provided based on the two-round Delphi technique.

In the first Delphi round that was performed by internists, from the 148 informational elements, 118 items remained, and 20 were discarded. In the second Delphi round that the endocrinologist performed, 114 items out of 118 elements remained, and the rest were discarded. Those elements with importance of 50% or less were saved for later studies (Table 2).

The obtained data and the final elements were listed based on the reliable scientific resources and professors' evaluations and finally divided into four groups of informational findings containing administrative data; sign, symptom, medical and family history data elements; Para- clinic diagnostic data; and treatment, and follow-up data. Administrative data included two main classes, four subclasses, and 14 data elements (Table 3). Sign, symptom, medical and family history data elements are presented in Table 4. Biochemistry tests findings, MRI and data findings of CT scan have been demonstrated in Table 5. Paraclinical diagnostic data for the registry of a patient with adrenal insufficiency, treatments and future follow-up are presented in Tables 5 and 6.

Discussion

Since the introduction of the computer system (1950) in the data management activities, the health care system also

Table 1. Demographic data profile of participants in Delphi survey

Participants	Number	Percentage of participants	Age group (y)	Experience (y)
Endocrinologist	20	48.78	40-51 51-60	15-20 20-25
Internist	15	36.5	30-40 40-50	10-15 15-20
Endocrinology fellows ship	6	14.63	35-40	5-10

Table 2. Overall view of selected elements by specialists

Adrenal insufficiency	No. of elements First Delphi-round	Delete percentage	No. of elements Second Delphi-round	Delete percentage	No. of final elements
	148	20	118	3	114

Table 3. Administrative finding data for registry of patients with adrenal insufficiency

Main class	Sub class	Elements
Patient Profile	Demographic	Age, national identity number, medical record number, gender, patient name and surname
	Socio-economic	Ethnicity, educational degree, job title, consanguineous marriage in parents of the patient
	Address	Type of residence (urban, rural), telephone number, mobile phone number
Healthcare provider profile	Care centre profile	Centre name, Date of visit

Table 4. Sign, symptom, medical and family history data elements for registry of patients with adrenal insufficiency

Main class	Subclass	Data element
Signs and symptoms, medical and family history	General signs and symptoms	Weakness, fatigue, anorexia, weight loss, nausea, vomit stomach ache, diarrhea, oligomenorrhea, hypermenorrhea, infertility, impotence, arthralgias, muscle cramps, hour/ temperature, height/ weight, hyperpigmentation – pallor, visual field defect, auricular calcification
	History and comorbidities in primary adrenal insufficiency	History of corticosteroid use in the last, hypopituitarism, history of pituitary or hypothalamic surgery, pituitary apoplexy, Sheehan syndrome, sarcoidosis, tb, eosinophilic granuloma lung tumor, pituitary radiotherapy, lymphocytic pituitary, breast tumor, drugs, head trauma
	History and comorbidities in secondary adrenal insufficiency	Mucosal cutaneous candidiasis, hypoparathyroidism, dental hypoplasia, alopecia, primary failure of the gonads, hypothyroidism, diabetes mellitus, pernicious anemia, fungal infection, HIV, metastatic tumors, hemochromatosis meningococcal adrenoleukodystrophy congenital adrenal hypoplasia, lateral adrenalectomy, mucosal cutaneous candidiasis, hypoparathyroidism, others
	Family history	General failure, dental hypoplasia, mucocutaneous candidiasis, drugs history

Table 5. Paraclinical diagnostic data for registry of the patient with adrenal insufficiency

Main class	Subclass	Data element
Paraclinical diagnostic	MRI findings	Pituitary mass, evidence of pituitary necrosis and regression, increase in stalk thickness, evidence of metastasis
	CT scan findings	Adrenal size, calcification, metastasis, bleeding, evidence of tuberculosis, and morning urine culture
	Biochemistry tests findings	Plasma aldosterone, plasma renin, CRH-stimulating test, Plasma cortisol, very low chain fatty acid, 17-hydroxy progesterone, IGF-1, FSH, LH, TSH, T4, estradiol and testosterone, ACTH level, cortisol and AM, cosyntropin test, FBS, lipid profile (cholesterol, TG, LDL, HDL), K +/Nao, VBG, PRL, PPD test

IGF1, insulin growth factor; FSH, follicular stimulating hormone; LH, luteinizing hormone; TSH, thyroid stimulating Hormone; T4, Thyroixine 4; FBS, fasting blood glucose; TG, triglyceride; VBG, vein blood gas; PRL, purified protein derivative; AM, ante meridiem; PPD, purified protein derivative.

benefited, and the hospital information system (HIS) with the aim of comprehensive patient information exchange between hospital sections or other health care centers to accelerate treatment process, improve health quality, and reduce costs was created in 1960 (16,17).

This electronic documentation in ISO-3 report includes the following classes; patient history- tests-personal, family, environmental, and psychological care information, allergies and other initial therapeutic values, preventive and therapeutic measures, such as vaccination and medical interventions in lifestyle, diagnostic tests and therapeutic interventions, such as procedures and therapeutic methods, clinical observations, interpretation and decisions and clinical reasoning, instructions.

Table 6. Treatment and follow-up data

Main class	Subclass	Data element
Treatment and follow-up	Treatment	Corticosteroids, fludrocortisone, treatment of the underlying disease if possible, DHEA dosage for female patients
	Follow-up	Changes in weight, pigmentation creation, hypertension and PR, weakness and fatigue, symptoms of Cushing's syndrome, and laboratory symptoms, such as blood urea nitrogen, creatinine, Na^+, K^+

PR, puls rate; DHEA, dehydroepiandrosterone.

For further examination of the patient, problems with differential diagnoses, reports, conditions and priorities, referral plans, functional status and medical record summaries are collected (17).

Most studies have shown that the use of record's software widely increases the quality of the service (18). Studies conducted in the US indicated that electronic discharge forms include further details, such as the diagnostic tests, treatment process and prescribed drugs at the time of discharge, and disease follow-up compared to the manual completion of forms.

Moreover, electronic records are completed and accessed in a shorter time in comparison to non-electronic records (19,20).

Despite complete recorded information of patients in modern medicine, they do not meet the vital needs of the health information delivery system due to their fundamental limitations and lack of a comprehensive and uniform data set for different diseases (16).

Therefore, to tackle this problem, we aimed to design a data set for adrenal insufficiency disease in this project. For this purpose, adrenal insufficiency was classified into seven types based on the available reliable resources. The associated symptoms, diagnosis methods, treatment and follow-up were put in separate parts.

The disease signs and symptoms were extracted based on the recorded recommendations from guidelines of different countries. Among the signs and symptoms recorded in the initial form, many findings were discarded based on the experts' opinions. Since our target population was experienced specialists familiar with the most common and significant symptoms and considering proposing a minimal and valuable data set, the uncommon findings and some redundant data were deleted in the second round of the Delphi technique.

Regarding laboratory findings, although some of the laboratory diagnostic and differentiating tests are not available in all laboratories in Iranian cities, according to the Delphi recommendation and hope to become available in the future, they did not exclude from the checklists.

In addition, secondary adrenal insufficiency occurs due to dysfunction of the hypothalamic-pituitary-adrenal axis. Subsequently, as a result of downregulation in cortisol production, a reduction in plasma ACTH occurs. Hence, in our designed data set registry for patients with adrenal insufficiency, the minimal data of adrenal insufficiency diagnosis based on the laboratory data such as laboratory level of cortisol and ACTH, and diagnostic tests, including the response of exogenous ACTH as well as the type of disease were considered.

On the other hand, the measures of aldosterone secreted from the adrenal cortex also change and destroy in this condition. Furthermore, the plasma level of renin increases and hypotension is doubled in the primary form of the disease. Therefore, in the presented data form, the minimal findings of adrenal insufficiency have been considered.

Conclusion

In this present study, we designed a data set for the registry of patients with adrenal insufficiency, including administrative data; sign, symptom, medical and family history data elements; para-clinic diagnostic data; and treatment and follow-up data to improve patient care treatment by providing comprehensive information. We suggest designing and implementing such data sets for other disorders to improve the quality of the health care system.

Limitations of the study

Since the present study was the first attempt to design a consistent data set for registry of patients with adrenal insufficiency and needed to participate and collect expert opinions, we encountered some limitations in access and getting the opinions of all experts and spent much time making repeated contacts with professors regarding their feedback on the questionnaires. Eventually, considering the valuable information provided by these checklists, application and widespread use of the recommended platform and implementation in HIS system needs health system providers cooperation to increase health system quality.

Acknowledgments

The authors would like to thank the Surgery Department of Internal Medicine, Diabetes Research Centre of Ahvaz Jundishapur University of Medical Sciences.

Authors' contribution

MZ and SML conceived the manuscript and revised it. MT and HS performed the study procedures, SN performed the data analysis, and prepared tables and figures.

Conflicts of interest

The authors declare no conflict of interest.

Ethical issues

This study was extracted from endocrinology fellowship thesis of Mahboubeh Taghipour at Ahvaz Jundishapur University of Medical

Sciences. The study was based on the approval of the Medical Ethics Committee of Jundishapur Ahvaz University (Ethical code# IR.AJUMS.REC.1395.305). All procedure performs in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compare ethical strand. Accordingly, written informed consent taken from all participants before any intervention.

Funding/Support

None.

References

1. Val P, Martinez A. Adrenal Cortex: From Physiology to disease. Front Endocrinol (Lausanne). 2016;7:51. doi: 10.3389/fendo.2016.00051.
2. Carbone E, Borges R, Eiden LE, García AG, Hernández-Cruz A. Chromaffin cells of the adrenal medulla: physiology, pharmacology, and disease. Compr Physiol. 2019;9:1443-502. doi: 10.1002/cphy.c190003.
3. Bornstein SR, Berger I, Scriba L, Santambrogio A, Steenblock C. Adrenal cortex–medulla interactions in adaptation to stress and disease. Curr Opin Endocr Metab Res. 2019;8:9-14. doi: 10.1016/j.coemr.2019.06.005.
4. Husebye ES, Pearce SH, Krone NP, Kämpe O. Adrenal insufficiency. Lancet. 2021; 2021;397:613-29. doi: 10.1016/S0140-6736(21)00136-7.
5. Martin-Grace J, Dineen R, Sherlock M, Thompson CJ. Adrenal insufficiency: physiology, clinical presentation and diagnostic challenges. Clin Chim Acta. 2020;505:78-91. doi: 10.1016/j.cca.2020.01.029.
6. Buonocore F, Achermann JC. Primary adrenal insufficiency: New genetic causes and their long-term consequences. Clin Endocrinol (Oxf). 2020;92:11-20. doi: 10.1111/cen.14109.
7. Puglisi S, Rossini A, Tabaro I, Cannavò S, Ferrau F, Ragonese M, et al. What factors have impact on glucocorticoid replacement in adrenal insufficiency: a real-life study. J Endocrinol Invest. 2021;44:865-72. doi: 10.1007/s40618-020-01386-3.
8. Ngaosuwan K, Johnston DG, Godsland IF, Cox J, Majeed A, Quint JK, et al. Increased mortality risk in patients with primary and secondary adrenal insufficiency. J Clin Endocrinol Metab. 2021;106:e2759-68. doi: 10.1210/clinem/dgab096.
9. Burger-Stritt S, Hahner S. Adrenal crisis. Internist (Berl). 2017;58:1037-41. doi: 10.1007/s00108-017-0307-z.
10. Pazderska A, Pearce SHS. Adrenal insufficiency–recognition and management. Clin Med (Northfield Il). 2017;17:258. doi: 10.7861/clinmedicine.17-3-258.
11. Graziadio C, Hasenmajer V, Venneri MA, Gianfrilli D, Isidori AM, Sbardella E. Glycometabolic alterations in secondary adrenal insufficiency: does replacement therapy play a role? Front Endocrinol. 2018;9:434. doi: 10.3389/fendo.2018.00434.
12. Hahner S. Acute adrenal crisis and mortality in adrenal insufficiency: still a concern in 2018!. Annales d'endocrinologie. 2018;79:164-6. doi: 10.1016/j.ando.2018.04.015.
13. Choquet R, Maaroufi M, de Carrara A, Messiaen C, Luigi E, Landais P. A methodology for a minimum data set for rare diseases to support national centers of excellence for healthcare and research. J Am Med Inform Assoc.22:76-;2015 85. doi: 10.1136/amiajnl-2014-002794.
14. Mandavia R, Knight A, Carter AW, Toal C, Mossialos E, Littlejohns P, et al. What are the requirements for developing a successful national registry of auditory implants? A qualitative study. BMJ Open. 2018;8:e021720. doi: 10.1136/bmjopen-2018-021720.
15. Henson KE, Elliss-Brookes L, Coupland VH, Payne E, Vernon S, Rous B, et al. Data resource profile: National cancer registration dataset in England. Int J Epidemiol.–49:16;2020 16h. doi: 10.1093/ije/dyz076.
16. Alotaibi YK, Federico F. The impact of health information technology on patient safety. Saudi Med J. 2017;38:1173. doi: 10.15537/smj.2017.12.20631.
17. Sligo J, Gauld R, Roberts V, Villa L. A literature review for large-scale health information system project planning, implementation and evaluation. Int J Med Inform. 2017;97:86-97. doi: 10.1016/j.ijmedinf.2016.09.007.
18. Howe JL, Adams KT, Hettinger AZ, Ratwani RM. Electronic health record usability issues and potential contribution to patient harm. JAMA. 2018;319:1276–8. doi: 10.1001/jama.2018.1171.
19. Marella WM, Sparnon E, Finley E. Screening electronic health record–related patient safety reports using machine learning. J Patient Saf. 2017;13:31-6. doi: 10.1097/PTS.0000000000000104.
20. Larsen E, Fong A, Wernz CH, Ratwani R M. Implications of electronic health record downtime: an analysis of patient safety event reports. J Am Med Inform Assoc. 2018; 25:187-191. doi: 10.1093/jamia/ocx057.