Medical Science Sample

Case Report

Acute Appendicitis Masquerading as Distal Intestinal Obstruction Syndrome in Adult Cystic Fibrosis

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Overshadowed by Ssino-pulmonary infections, cCystic fFibrosis (CF) commonly affects gastrointestinal organs because of secretory and motility dysfunction. Infrequently, the resultingse changes can result incause dDistal iIntestinal Oobstruction sSyndrome (DIOS), an more and moreincreasingly diagnosed gastrointestinal conditionentity in adult Cystic FibrosisCF patients. We present thea case of a 22-year-old manle who presented to our hospital with right lower quadrant abdominal pain. with Despite the suspicion of acute appendicitis, the patient and was subsequently diagnosed as with DIOS. Our case highlights the importance of considering DIOS as a differential diagnosis of for right lower quadrant abdominal pain in CF patients, especially for by physicians working at community hospitals thatwhich may not have a CFystic Fibrosis care program available.

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1. Introduction

Cystic Ffibrosis (CF) is a genetic disease of that affects multiple organs. With Because of advancementsing in the managementing of CF patients, patients can now often survive become to adulthoods [1]. However, the iImproved life expectancy among adult CF patients has given riseled to an increase in extrapulmonary, notably gastrointestinal, man- ifestations, which did not happen was previously uncommon. Distal Iintestinal oObstruction Ssyndrome (DIOS) continues to be a rising complication in adult CF patients, presenting aswith acute abdominal pain like and mimicking an acute abdominal emergency.

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2. Case Report

A 22-year-old Turkish-origin manle with a past medical history of Cystic FibrosisCF presented with a one-day history of right lower quadrant abdominal pain. He described a sharp periumbilical pain that continued to worsen, which then shifted to the right lower quadrant of the abdomen. Prior to the onset of the abdominal pain, he reported experiencing nausea and anorexia for three days. His last bowel movement was two

days prior to admission. Upon reviewing the patient's past history, it was noted that he had several episodes of pneumo-nia, for which he was appropriately treated with antibiotics.; Notably, no history of constipation or recurrent abdominal discomfort was reported prior to this. At home, the patient was prescribed aAlbuterol inhalationer as needed, dDornase aAlfa inhalationer, aAztreonam lysine nebulization, 500 mg aAzithromycin three times a week, lLansoprazole, lLumacaftor-ivacaftor twice a day, lLipase-protease-amylase capsule three times a day, and a multivitamin capsule once a day. The patient was also diagnosed with Cystic FibrosisCF at the age of four, and thehis disease progressed to exocrine pancreatics insufficiency, which was being treated with pancreatic enzymes. On abdominal examination, he was found to havehad diminished bowel sounds and tenderness on right lower quadrant with equivocal rebound tenderness on the right lower quadrant. Lab-oratory analysis showed leukocytosis (white blood cell count,WBC 13.0 mm/K3;, nNeutrophils count, 62%) with a normal differential. He had no electrolyte imbalances. Computed tTomography (CT) of the aAbdomen revealed thickening, and edema around the termi-nal ileum, inflammatory changes in the a colon with inflammatory changes, free fluid in the right paracolic gutter adjacent to the cecum, an appendix measuring 5.3×4.6 mm, and reactive lymph nodes (Figures 1 and 2).

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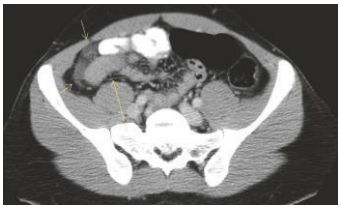

FIGURE 1: Axial abdominal computed tomographyCAT scan depicting thickening around the terminal ileum and colon (yYellow arrows) along with extralumi-nal fluid and reactive lymph nodes.

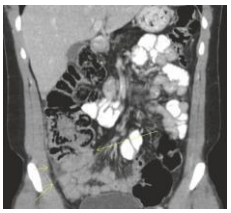

FIGURE 2: Coronal view computed tomography scan with showing thickening of the ileum with a distended appendix (yellow arrows).

measuring 5.3*4.6 mm, and reactive lymph nodes (Figures 1 and 2). Due to extraluminal fluid and cecal wall edema with inflammation, early acute appendicitis could not be excluded as a possible diagnosis. Surgical intervention was performed required, which revealed a ruptured microperforation of a cecal diverticulum and a distended appendix in chronic adhesions, for which he required an appendectomy and partial cecectomy with an intact ileocecal valve (IC valve) valve. Postoperatively, he was diagnosed with DIOS and was subsequently started on pPolyethylene gGly-col. The patient made an unremarkable recovery and was discharged. home to beHe was followed up in the

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outpatient clinic ~~without~~ and did not have ~~any~~ recurrence of any symptoms.

3. Discussion

~~Distal Intestinal Obstruction Syndrome (~~DIOS,~~)~~ ~~was~~ previously ~~called~~ known as~~a~~ Meconium Ileus ~~-~~equivalent ~~in the past~~, ~~described~~ is characterized by the collection of viscid fecal material within the lumen combined with sticky mucoid intestinal content adherent to the intesti~~-~~nal wall of the terminal ileum and cecum [1]. Perez-Aguilar et al. reported that the~~a~~ prevalence of DIOS was 19.5% (mean age 20.6 years) among 46 CF patients in a retrospective analysis, while Dray et al. ~~conducted a cross-sectional study~~ report~~eding~~ a 15.8% (mean age 28.9 years) prevalence ~~in~~ among 171 CF patients in a cross-sectional study [2, 3]. Despite the~~Though there continues to be a~~ limited assessment ~~of~~ on the prevalence of DIOS in adult CF patients, DIOS is ~~considered~~more common among adults ~~compared to~~than among children ~~due to~~because of ~~increased~~ disease progression.

Defective intestinal chloride and water secretions into the gut, luminal acidity, and loss of bile salt all contribute to the

development of DIOS [1]. These patients characteristically present with right lower quadrant pain, nausea, abdominal distension, and failure to pass stools or flatus [1, 3]. In some patients, a palpable right lower quadrant mass ~~can~~ may be ~~appreciated~~ present that may be confirmed on abdominal radiography~~X-ray~~ [1]. Though abdominal ~~X-rays are~~radiography is recommended to aid in the diagnosis of DIOS, ~~they are~~it is inadequate in differentiating ileus from other causes of abdominal pathologies that may present in ~~Cystic Fibrosis~~CF patients [4]. Due to ~~the proximity of~~ the anatomical ~~locations~~proximity, as well as the overlapping clinical presentations, appendicitis and intussusception may mimic DIOS, which further leads to diagnostic uncertainty. Overlap of several intra-abdominal pathologies in CF increases the risk of misdiagnosis, especially ~~with~~ for acute appendicitis, as these ~~patient's~~ underlying pathologies may be masked in patients with pulmonary infections~~'~~ using antibiotics [5, 6].

Osmotic laxatives are the cornerstone of bowel regimens for the treatment of DIOS. The most commonly prescribed laxative is p~~P~~olyethylene ~~G~~glycol, ~~(PEG)~~ administ~~errat~~ed at a dose of 20-~~-~~40 ml/k~~K~~g/h~~H,~~ ~~up t~~with~~o~~ a maximum of 1 l~~L~~/kg/h for a total of 8 hours, resulting in a~~achieving~~ fecal effluent consisting of clear fluid, along with the resolution of abdominal pain and constipation [1, 6]. If the diagnosis remains unclear, and thus, requires surgical intervention, IC~~ileocecal~~ valve resection should be considered to prevent the development and recurrence of intestinal obstruction sequalae ~~and growth~~, especially in adolescents [7].

With the increase in immigration of foreigners into~~through~~ America, inner-city and community hospitals may not be sufficiently equipped with a ~~Cystic Fibrosis~~CF care center; moreover,~~nor~~ ~~may~~ these hospitals may not have programs in provision, with expertise available to other clinicians involved in patient care.

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

All authors contributed to the revision and approval of the manuscript.

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Life Sciences Sample

Case Report

Methylmalonic Acidemia with Novel *MUT* Gene Mutations

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A 5-years -old boy presented with recurrent episodes of fever, feeding problems, - and lethargy, fromsince the age of 11 months, and poor weight gain. He was admitted to our hospital and evaluated for metabolic disorders; subsequently, hecauses and was diagnosed withas methylmalonic acidemia (MMA). He was treated with vitamin B12 and carnitine supplements and has been on followed -up for the last 3 years. Mutation analysis by next generation sequencing (NGS), supplemented with Sanger sequencing, revealed two novel variants in exon 5 and exon 3 of the *MUT* gene responsible for the methylmalonic acidemiaMMA in exon 5 and exon 3. Recently, he had developed dystonic movements including orofacial dyskinesia. With the advent of NGS, judicious use of NGS with Sanger sequencing can help identify causative and possibly pathogenic mutations.

1. Case Presentation

A 5-year-oldThe childboy presented for the first time at the age of 11 months, with complaints of fever, vomiting, poor feeding, and lethargy for the first time at the age of 11 months.- We observed that the patient he had pallor and tachypnea and was drowsy. Further evaluation was suggestedive of high anion-gap metabolic acidosis with ketonuria (urine ketones 3+) and with normal electrolytes, blood sugar (94 mg/dLl), vitamin B12, and homocysteine levels. Plasma ammonia and plasma lactate were was 118 units, and plasma lactate was 2.9 units, respectively. Transcranial magnetic stimulation TMS results wereas normal, but gas chromatography mass spectrometry analysis of but urine GCMS revealed elevated 3-OH propionic acid [12.39 retention time (RT)] as well asand elevated methyl malonic acid levels [16.92 RT, Suppl Figure 1, in Supplementary Material available online at https://doi.org/10.1155/2017/8984951]. Since then, the this child patient was on a low -protein diet, and carnitine, biotin, thiamine, and vitamin B12 injections. The cChild was thereafter admitted to the hospital on seven multiple occasions (7 times) with acute decompensation and managed as per protocol. Mutational analysis was sent for methylmalonic acidemia (MMA) which showed a single heterozygous missense variant c.976 A>G (p.Arg326Gly) in exon 5 of the *MUT* gene (genomic coordinates: chr 6: 49421405): as a variant of uncertain significance. Chromosomal microarray analysis done did not reveal any major deletion or duplication that which could disrupt the gene. Since exon 3 and exon 6 were not adequately covered by next generation sequencing (NGS), further evaluation by Sanger sequencing for targeted exons was performeddone, and a second 2nd mutation in exon 3 c.753 G>A (p.=) was identified. The variants were predicted as found to be damaging by the on SIFT database score (Suppl data) and as They were also predicted to be deleterious by on Polyphen-2 and Mutation-Taster, but

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they were ~~and~~ absent ~~not found~~ in the ExAC database. Brain magnetic resonance image ~~MRI brain~~ of the patient (~~done at~~from the age of four~~4~~ years) ~~was~~ showed~~ing~~ multifocal cystic encephalomalacic changes with surrounding gliosis in deep white matter predominantly in frontoparietal regions (Figure 1). During ~~In~~ the latest admission of the patient to the hospital, we observed ~~child was found to have~~ fresh neurological findings in the form of perioral tremors, generali~~z~~sed hypertonia, and generali~~z~~ed dystonia with clonus with exaggerated deep tendon reflexes. The patient ~~He~~ was treated with intravenous dextrose and sodium bicarbonate and was continued on carnitine and ~~injection of~~ vitamin B12 injections. Plasma ammonia and plasma lactate were ~~was~~ 18 units and ~~lactate level was~~ 4.9 units, respectively. Brain magnetic resonance image ~~MRI brain~~ of the patient~~was repeated~~ ~~and~~ revealed bilateral basal ganglia hyperintensities, suggestive of metabolic stroke. After the subsidence of acute crisis, he was discharged on carnitine~~,~~ ~~injection of~~ vitamin B12~~,~~ injections, and trihexyphenidyl. His p~~P~~arents were counseled regarding the prognosis and for prenatal diagnosis for ~~next~~ subsequent pregnancies~~y~~.

2. Discussion

~~2.~~

MMA presents with lethargy, acidosis, hypoglycemia/ hyperglycemia, ketosis, and recurrent episodes. MMA ~~due to *MUT* gene mutations~~ usually leads to severe phenotypes due to *MUT* gene mutations, and around 35–40% of cases are due to novel~~ew~~ mutations [1, 2]. ~~There can be~~ M~~m~~issense or nonsense mutations, deletions, insertions, and so on in the *MUT* gene ~~and so on~~ can lead~~ing~~ to a clinical phenotype.

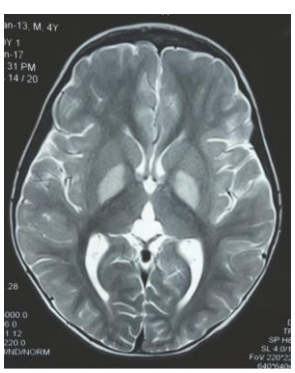

FIGURE ~~F~~IGURE ~~The~~ Brain magnetic resonance image ~~MRI brain~~ of~~in~~ the child with MUT-related methylmalonic acidemia~~MMA~~ showing predominant frontoparietal abnormalities in the form of encephalomalacia and gliosis.

The advent of NGS technology has enabled better characterization of mutations in several populations. However, Sanger sequencing remains a useful adjunct in molecular testing in~~of~~ these cases. It is required to find mutations when there is a strong clinical suspicion for them ~~. Sometimes in NGS, due to~~because of incomplete coverage of the exons by NGS~~, Sanger sequencing is required to find mutations, if there is strong clinical suspicion~~. In this study, by using both the techniques ~~By careful use of both techniques,~~ we ~~could~~ found~~ind~~ the two *MUT*

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variants responsible for- MMA in the patient~~the clinical condition.~~ In a Saudi study on 60 ~~patients of~~ MMA patients, nonsense, missense, and frameshift mutations were detected across the *MUT* gene [3]. Another study in 43 Chinese patients identified 8 recurrent mutations and 10 novel mutations [4]. A previous Indian study in 15 patients with ~~of~~ clinically diagnosed MMA identified one novel exon 12 mutation in the *MUT* gene with predicted pathogenicity. In this case~~Here~~, we identified two novel variants, one in exon 3 and another in exon 5 of the *MUT* gene. Both were labelled as variants of unknown significance ~~(VUS)~~. The exon 3 variant is a synonymous variant, and a different nucleotide change c.753 G>C (p.Lys251Asn) has been reported earlier in ClinVar. Some synonymous variants can also affect ~~the~~ splicing or protein function and lead to clinical phenotypes. The identified exon 5 variant is novel~~new~~, but another close variant c.977 G>A (p.Arg326Lys) has been reported in ClinVar. The variants were found to be deleterious on bioinformatic analysis and were absent ~~not found~~ in the ExAC database. Both variants identified in the present case could ~~possibly explain~~be responsible for the ~~phenotype of~~ MMA phenotype in the child. *MUT*-related MMA has poor prognosis in most cases. Specializ~~s~~ed diet and supplements may not improve the outcome~~s,~~ even if MMA is diagnosed early. Early recognition and appropriate treatment of acute crises are necessary. Metabolic stroke can sometimes occur in the absence of acute metabolic decompensation, so meticulous neurological examination at every ~~each~~ visit is useful. The treatment options ~~for therapy~~ include early liver transplantation [5] and possibly gene therapy in the future. Genetic counseling and prenatal diagnosis could help the~~se~~ families of the patients in making reproductive decisions.

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

The authors would like to acknowledge Dhiti Omics Tech–nologies Pvt Ltd for help in mutation analysis.

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Physical Science Sample

Structural ~~Prediction~~ prediction of ~~Bis~~bis(di-p-anisole)-1,4-azabutadiene-bis[triphenylphosphine]ruthenium(II) ~~U~~using ^{31}P NMR ~~Spectroscopy~~spectroscopy

Author Details

Abstract[1]

The present paper reports the use of ^{31}P NMR spectroscopy to predict the isomers ~~structures~~ of [bis-4-methoxy-phenyl-[3-(4-methoxy-phenyl)-allylidene]-amino]-bis[triphenylphosphine]ruthenium(II), also known as bis(di-p-anisole)-1,4-azabutadiene-bis[triphenylphosphine]ruthenium(II), complexes. The complexation reaction was carried out using (di-*p*-anisole)-1,4-azabutadiene (compound **1**), triphenylphosphine, and ruthenium chloride in 2:2:1 ratio under refluxing conditions ~~of (di-p-anisole)-1,4-azabutadiene (compound 1), triphenylphosphine (PPh$_3$), and ruthenium chloride in the ratio of 2 : 2 : 1~~ for ~~five~~ 5 h~~ours~~. The formation of the ~~In addition,~~ ruthenium(II) complexes ~~were~~ was further confirmed by~~also characterized using~~ FTIR and UV–Vis spectroscopic~~y~~ analyses~~to support the formation of ruthenium(II) complexes~~. The results of ^{31}P NMR spectroscopy ~~pic study on ruthenium(II) complexes suggested~~ indicated the presence of ~~that there are~~ three isomers ~~present~~ after the complexation reaction.

Keywords:

[1] NMR, nuclear magnetic resonance;

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Should you have any questions, please feel free to get back to me.
My best wishes for your success with the manuscript.

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1. Introduction

Nuclear magnetic resonance (NMR) spectroscopy is an essential instrument analytical tool in the field of chemistry as it can helps determine elucidate the structure of a molecule, identify detect the presence of impurities in a sample, and determine the rates of formation and as well as degradation of a compound. Even in 1970s , NMR has was used as early as in the 1970s already been used to determine detect the cancer formation which and was identified to be offered a simple, fast, and low cost method to for this purpose identify cancer formation [1–3].

In As part of our long term research interest on the synthesis of in ruthenium(II) complexes synthesis, we used the (di-*p*-anisole)-1,4-azabutadiene (**1**) and triphenylphosphine (PPh_3) as the ligands to for reaction react with ruthenium trichloride under reflux conditions. The resulting pProducts were formed, were checked analyzed by using ^{31}P NMR spectroscopy, and the spectral observationsresults found in the spectra are worth to be discussceded in the present communication.

For Inorganic inorganic chemists commonly use, using of ^{31}P NMR spectroscopy to identify the structure of a complex containing phosphine ligands is very common [4, 5]. ThFor example, this technique has been usede well-known examples is the use of ^{31}P NMR spectroscopy to determine elucidate the mechanism of Wilkinson hydrogenation mechanism based on by identifying the coupling patterns among the phosphine ligands as well as those and also the coupling constants between the phosphine ligands as well asand the rhodium(I) metal centrecenter [6].

2. Methodology

The ruthenium complexes were characterized using UV–*f*Vis, FTIR, and ^{31}P NMR spectroscopiesy. The IR spectra were recorded using on a Thermo Scientific Nicolet iS10 spectrophotometer in using KBr discs. The ^{1}H NMR spectrum for of compound **1** and ^{31}P NMR spectrum for of the ruthenium(II) complexes were recorded usingon a JEOL JNM-ECA 500 spectrometer with TMS as an the internal standard. The absorption spectra waswere recorded with on a Jasco V-630 UV–Vis spectrophotometer.

2.1. To prepare Preparation of (4-Mmethoxy-phenyl)-[3-(4-methoxy-phenyl)-allylidene]-amine or (di-*p*-Aanisole)-1,4-azabutadiene (**1**),

4-Methoxycinnamaldehyde methoxycinnamaldehyde (1.62 g, 10.00 mmol) was dissolved in 10 mL of ethanol, and followed by the addition of 4-methoxyaniline (1.23 g, 10.00 mmol) which was then added to solution. The rReaction mixture was stirred and to obtain a resulted in green-yellow solid, which. The solid was filtered, washed with 5 mL of ethanol, and dried *in vacuo*. The solid was purified by dissolving it in DCM and layered with hexane via slow diffusion.: Yyield: 2.368 g (88.7%); IR (KBr, cm^{-1}) ν: 3036 (C-H stretching), 1627 (C=N- stretching), 1601 (C=C stretching, aliphatic), 1575 and 1468 (C=C stretching, aromatic), and 1110 (OCH_3 stretching);: ^{1}H NMR (500 MHz, $CDCl_3$,) δ: 8.25 (d, 1H, Hz, -CH=N-), 7.47 (d, 2H, Hz,), 7.18 (d, 2H, Hz,), 7.05 (t, 1H, Hz, H-C_α), 6.99 (m, 1H, H-C_β), 6.90 (d, 4H, Hz,), 3.83 (s, 3H, OCH_3), and 3.81 (s, 3H, OCH_3); UV–Vis (DCM, /nm): 273, 373; Anal. Calc. for $C_{17}H_{17}O_2N$ (%): C, 76.38; H, 6.41; N, 5.24; Ffound (%): C, 76.75; H, 6.31; N, 5.05.

To prepare 2.2. Preparation of [Bbis-4-methoxy-phenyl-[3-(4-methoxy-phenyl)-allylidene]-amino]-bis-[triphenylphosphinecate]ruthenium(II) or Bbis(di-*p*-anisole)-1,4-azabutadiene}-bis[triphenylphosphine]ruthenium(II) Complexcomplex, es

$RuCl_3 \cdot xH_2O$ (2.070 g, 1.0 mmol) and PPh_3 (0.525 g, 2.0 mmol) were added to a round bottom flask containing 10 mL ethanol, and the mixture was then refluxed. Compound **1** (0.316 g, 2.0 mmol) was then added to the round bottom flask, and the mixture was refluxed again. The resulting pPale maroon solids were wasformed , filtered and washed with hexane, and the p. Precipitate was dried *in vacuo*: IR (KBr, cm^{-1}) ν: 3034 (C-H stretching), 1661 (C=N), 1576 (merged IR band of for aliphatic and aromatic C=C stretching from aliphatic and aromatic), 1469 (C=C stretching of aromatic ring), and 654 (Ru-C), and 577 (Ru-N);: ^{31}P NMR (202.5 MHz, $CDCl_3$) δ: 49.7 (d, 1P, Hz), 47.4 (d, 1P, Hz), 41.7 (d, 1P, Hz), 39.7 (d, 1P, Hz), 35.1 (s, Ph_3P=O), and 29.9 (s, 1P); UV–Vis (DCM) (): 321 and 382.

3. Results and Discussion

The Characterization of the ruthenium complexes were characterized was done usingby UV/–Vis, FTIR,

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and ^{31}P NMR ~~spectroscopy~~spectroscopies. The IR spectra ~~was~~ were recorded ~~found~~ on a ~~by~~ Thermo Scientific Nicolet iS10 spectrophotometer ~~in~~ using KBr discs. ^{1}H NMR spectrum ~~for~~ of compound 1 and ^{31}P NMR ~~spectrum~~ spectra for the ruthenium(II) complexes were recorded on a ~~obtained through~~ JEOL JNM-ECA 500 spectrometer with TMS as an internal standard. The absorption spectra were recorded ~~with~~ on a Jasco V-630 UV–Vis spectrophotometer.

The ^{31}P NMR spectrum of the ruthenium complexes (Fig. 1) shows ~~appearance of~~ two pairs of doublets and one singlet, indicating ~~in the ^{31}P NMR spectrum for ruthenium complexes (Figure 1) indicate~~the presence of ~~that there are~~ three isomers (1:1:1 ratio) ~~present in~~during the complexation reaction ~~with the ratio of 1 : 1 : 1~~.

~~Figure~~Fig. 1: ^{31}P NMR spectrum ~~for~~ of ruthenium(II) complexes.

The singlet at 29.88 ppm reveals that the two PPh_3 units are magnetically equivalent in the ruthenium(II) complex. The ~~In this case, the~~ two PPh_3 units are ~~either~~ located at the axial position and are~~, which is~~ trans to each other (~~Figure~~Fig. 2(a)) [7], or ~~located at~~in the equatorial plane~~, which is only~~ trans only to ~~either~~ one of the C atoms ~~from~~ in the C=C bond or the N atom ~~from~~ in the N=C –bond (~~Figure~~Fig. 2(b)).

~~Figure~~Fig. 2: Postulated structures of (a) *trans*- and ((b) and (c)) *cis*-[bis(di-*p*-anisole)-1,4-azabutadiene~~}~~]-bis[triphenylphosphine]ruthenium(II).

~~Meanwhile, a~~ The pair of doublets at 41.84 and 39.74 ppm with a coupling constant of 21 Hz is assigned to ~~a~~ the cis isomer of the ruthenium(II) complex, as shown in ~~Figure~~Fig. 3(a). ~~Lastly~~ A~~, a~~nother pair of doublets at 49.80 and 47.36 ppm with a coupling constant of 38 Hz is assigned to ~~a~~ the trans ruthenium(II) complex (~~Figure~~Fig. 3(b)). The difference in coupling between the ruthenium(II) complexes in ~~Figures~~Fig. 3(a) and 3(b) is due to the positions of the PPh_3 ligands. The smaller coupling constant of ~~t~~, ~~namely,~~ 21 Hz is ~~, was~~ assigned to the cis isomer because both the PPh_3 ligands are in the equatorial plane. Fig. 3(a) shows ~~The presence of~~ doublets, ~~which are for~~ assignable to the PPh_3 ligands in the complex ~~is shown in Figure 3(a)~~ because both the ~~PPh_3~~ ligands are trans to different atoms~~, that is,~~ (nitrogen and carbon) ~~atoms~~. ~~For~~ In the ruthenium(II) complex (~~as shown in Figure~~Fig. 3(b)), the two PPh_3 ligands are located at the axial position and are trans to each other. The ~~Lastly, the~~ single peak observed at 35.14 ppm is attributed to the ~~presence of the~~ triphenylphosphine oxide [8].

~~Figure~~Fig. 3: Postulated structures of (a) *cis*- and (b) *trans*-[bis(di-*p*-anisole)-1,4-azabutadiene]~~}~~-bis[triphenylphosphine]ruthenium(II)~~}~~.

~~On the other hand, the~~The binding of compound **1** to the ruthenium(II) metal ~~centre~~center is ~~can be~~ confirmed using FTIR and UV–Vis spectroscopy~~ies~~. Comparison of~~ing~~ the IR spectra ~~between of~~ compound **1** and the ruthenium complexes (~~Figure~~Fig. 4) reveals that ~~,~~ the ~~vibrations of~~ C=N and C=C stretching bands ~~bands~~ are ~~have been~~ shifted after binding to the ruthenium(II) metal ~~centre~~center. The ~~For~~ C=N stretching band ~~, it~~ shift~~es~~d from 1627 cm^{-1} in the spectrum of ~~compound~~ **1** to 1661 cm^{-1} in the spectrum of the ruthenium complex [9, 10]. In contrast~~,~~ ~~whereas~~ the ~~for~~ C=C stretching~~, the IR~~ band appears at 1601 cm^{-1} in the spectrum of ~~**compound** **1**~~ but ~~it~~ is not clearly ~~shown~~ detected in the spectrum of the complex because the ~~IR bands of~~ aliphatic and aromatic C=C bands ~~for aliphatic and aromatic were~~ merg~~ed~~ing into ~~one~~ a single broa~~r~~d ~~IR~~ band ~~centred~~centered at 1576 cm^{-1}. Nevertheless, the two additional ~~IR~~ peaks ~~are present~~ at 577 and 654 cm^{-1} in the finger-print region of the spectrum ~~at 577 and 654 cm^{-1} indicating~~confirm the formation of the respective Ru-N and Ru-C bonds [11].

~~Figure~~Fig. 4: IR spectra of (a) compound **1** ~~(a)~~ and (b) ruthenium(II) complexes ~~(b)~~.

The complexation of compound **1** to the ruthenium(II) metal ~~centre~~center is ~~can be~~ further supported by the UV–Vis ~~data~~ spectra ~~as~~ shown in ~~Figure~~Fig. 5. ~~For~~ In the case of compound **1**, two absorption bands ~~were~~ are observed at 273 and 372 nm, which are assigned to the transition of the benzene ring and ~~transition of the~~ imine group [12], respectively. After the complexation, both absorption bands show significant shift~~s~~ to 321 and 382 nm, respectively, ~~demonstrating the Significant shifts of these two absorption bands have proven compound 1 was~~ successful~~lly~~ ~~bound~~ binding of **1** to the ruthenium(II) metal ~~centre~~center via the nitrogen atom ~~from~~ in the C=N group and the carbon atom ~~from~~ in the aliphatic C=C ~~aliphatic~~ group ~~in~~ of the C=C-C=N moiety.

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~~Figure~~Fig. 5: UV–~~-~~Vis spectra of (a) compound **1** ~~(a)~~ and (b) ruthenium (II) complex ~~(b)~~.

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~~4. Conclusion~~

~~The~~ Based on ^{31}P NMR spectral evidence, we confirmed ~~from ^{31}P NMR spectrum has shown~~ the presence of three isomers of the bis(di-*p*-anisole)-1,4-azabutadiene~~}~~-bis[triphenylphosphine]ruthenium(II) complex, in ~~the~~ 1:1:1 ratio ~~of 1 : 1 : 1~~. In addition, ~~the data from~~ IR and UV–~~-~~Vis spectral data revealed the successful binding of ~~at~~ compound **1** ~~has bound~~ to the ruthenium(II) metal ~~centre~~center.

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